(FINAL REPORT)

Review of Natural Resources Management Policy Studies in the East African Highlands (Kenya, Uganda and Tanzania)

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December 2003

EXECUTIVE SUMMARY

In Sub-Saharan Africa (SSA) food production has not kept pace with population growth rate, making it the only region in the world with declining per capita agricultural production and per capita food consumption. A large proportion of increases in agricultural production in the past were achieved mainly from area expansion rather than increased productivity, as was the case else in the world. But extensive cultivation to increase food production in the region is no longer an option because land is no longer abundant. Continued food insecurity in SSA is a manifestation of production methods made unsustainable by population growth, nutrient mining and scarcity of alternative land. These factors have not operated in isolation: social institutions and governance have not responded adequately to these constraints.

The low agricultural productivity, increasing poverty, and degradation of natural resources in the Highlands of Kenya, Uganda and Tanzania raise concern because these areas hold more than 50% of the population and the bulk of agriculturally productive resources in the three countries. With this back ground, the objective of the study was to review natural resource management (NRM) policy research studies in the three countries to: determine the key policy problems related to NRM, synthesize key lessons from the studies, prioritize key gaps for further research, and to list major institutions in the region with capacity in NRM policy research.

Despite common problems, the three countries in East Africa have unique differences not only in the physical endowment but also in historical setting, socio-economic conditions, institutions and policies which have impacted on agriculture and natural resource use and management to date. None-the-less, policy failures are linked to low agricultural productivity and in turn to poverty because stakeholders' involvement in decisions affecting them has been lacking, and the link between planning and budget allocation has been missing, resulting in under funding of key sectors like agriculture. The liberalization process embraced as the remedy to these problems was not comprehensively thought through and did not deliver the anticipated benefits.

THE KEY NATURAL RESOURCE MANAGEMENT POLICY PROBLEMS

Problems of managing the natural resources

Sustainable use of natural resources-These problems are diverse but they hinge on unsustainable use of natural resources resulting in poverty and environmental degradation. Sustainable use and management of natural resources is achieved when human needs from these resources are met through production systems which improve and enhance the natural resource base and environmental quality, use non renewable resources in an efficient manner, and increases economic viability of agricultural systems, by utilizing natural biological systems and controls. Local institutions, users groups, research**,** extension and enabling policy, team up to produce the desired resource-conserving technologies.

Soils - Human induced land and soil degradation in form of water and wind erosion, including chemical and biological deterioration, threaten sustainable agriculture. Land degradation and declining soil fertility is a major challenge in sustainable use of natural resources in agriculture in general and in the Highlands in particular. But the wider challenge is one of making better use of available biophysical and human resources, by minimizing the use of external inputs, by optimising the use of internal resources, or by a combination of both. In this way, efficient and effective use of what is available is ensured, and any improvements made will persist, because dependencies on external systems are kept to a reasonable minimum**.**

Integrated soil fertility management underscores that both organic and mineral inputs are needed and none of them can be entirely substituted by the other, in sustainable crop production. Farmers are unable to increase productivity significantly using locally available manures alone, because enough of it can not be produce. In addition, increased use of organics is further limited by bulkiness and seasonal availability. Therefore integrated soil fertility management is needed to simultaneous pay attention to land activities on cultivated land from land preparation to harvesting, management of water and nutrients and to increased access to and use of fertilizers.

Water and soil fertility management technologies are labour intensive. Consequently, their use is likely to have different implication in terms of additional labour requirements, labour timing and returns, for different social groups, such as men, women, old people and the young. The wider concern is that the link between sustainable NRM and social economic characteristics of households is not clearly understood. Soil fertility maintenance practices in agricultural production are limited not only by ability but also by perception, knowledge and incentives to farmers. They may also be competing against opportunities of earning off-farm income. More research is required to tap local knowledge in informing development of efficient soil and water management technologies. The possibility of modifying tillage practices and amount of inputs depending on wet and dry years, to increase yield and reduce losses accordingly, needs further documentation.

Empirical evidence shows that there can be situations where increased population densities prompt households to engage in more land and labour intensive production technologies such as intercropping, and continue fallowing to prevent soil loss and manage fertility. Therefore, the commonly held view that fallow period will decrease with increase in population, need not always hold. The policy implication is that a workable short-term strategy of facilitating farmers access to intercropping technologies, may allow them to continue with fallowing for soil fertility management practices under decreasing land/population ratio.

Irrigation and water harvesting - The need for water to increase productivity and to harness synergies of natural resources is undisputed. The contentious issue is whether water use can be made more sustainable and whether agriculture can justify the opportunity cost. One option is to broaden the definition of irrigation to include water harvesting. The available literature shows that water harvesting technologies focus on the semi arid areas, although water is a limiting factor in the Highlands as well, particularly for farmers targeting off season production. Smallholder irrigation projects have performed well below their potential. It now realized that they were planned without due involvement of farmers who are the best placed stakeholders to handle the day to day management.

They also overlooked that irrigated agriculture would have to fit within the other livelihood earning strategies in the area.

Forests and tree resources - The net change of -0.78% in forest area annually in Africa or loss of 5.3 million hectares per year is the highest globally. East Africa contains 23% of the forest found in Africa, but most of the natural forest estate in not under any known management plan. Increased pressure from human and livestock population on limited forest resources has caused and intensified negative effects such as: overexploitation, overgrazing, soil erosion and excision of forests for cropland, unsustainable draining of nutrients, and destruction from fires, urbanization, mining, road infrastructure, droughts, floods, settlements for migrating people, and conflicts. The resulting poverty and environmental degradation has prompted evolution of revised approaches to forest management which make forest management people-centered rather than tree or forest centered, as done in the past.

Community-based forest management is inspired by widespread problems of access to forest resources by the local people. Some of these problems are mismanagement of the forest, high level corruption among forest managers, preferential treatment in favour of outsiders, relative to the local people in access to forest resources, and lack of direct and observable financial benefits from the forest by the local people. The constraints to community forest management revolve around the issue of ownership of the forests and the identity of the local community which would set the rules of use and enforce them in the day to day management of the resource.

Policy and research as constraints to natural resource management

Effective NRM policy research requires that the constituents of natural resources be articulated and components of their management specified. It is also crucial to establish what constitutes policy in the NRM context. Since the policy maker is supposed to be the main consumer of policy recommendations from research, it is important to understand the nature of policy makers, the environment within which they operate and their perception of the value of empirical research input in formulating policy. The review found that these concerns are not fully addressed in the case of NRM policy research for the Highlands.

Political factors as constraint to natural resource management

Governments in the three countries maintain inadequate funding to agriculture and NRM programs even though the sector generates the bulk of gross national product. In some cases, the alternative is donor funding, conditional on carrying out reforms under considerable pressure to show quick results. Own funds would allow adequate time for learning as the reform process evolves, particularly for those with long term impact on NRM. National NRM policy strategy to guide policy research is lacking. Therefore policies are not implemented, regulations are not enforced and sometimes different sectors operate with policies that are in conflict. Additional problems arise from inadequate investment in building capacity and investing in human resources for NRM, in facilitating relevant policy research and training, in entrenching communicating with stakeholders, donors and private sector participants, and in supporting multidisciplinary research and farmer participation in devising NRM strategies. The potential of farmer groups and associations is not tapped and experiences from other countries are not heeded.

Community and institutional problems in natural resource management

Limited success achieved by past efforts at generating solutions to NRM problems were linked to failure to combine physical, economic and social components which are the linchpins that drive NR processes. Institutions, governance and power relationships are some of the social components. In addition, NRM policy is not handled as a process which evolves and avails learning opportunities. Above all, policy researchers have not focused on *how* to implement the recommendations they deem needed to reduce poverty with sustainable use of resources. Yet, this is the very question that perplexes policy makers in agriculture. Inadequate knowledge management in NRM partly explains the paucity of implementable options given by researchers. Economies of scale are not exploited in sharing both data and experiences; therefore NRM successes, failures, and informal knowledge have not been capitalized on.

It is also not clear how adoption of NRM strategies can be scaled-up and diversity of ecological conditions can be accommodated. The role of non-farm activities in household income appears to be changing, implying that more research is needed to shed light on the

impact of non-farm income on agricultural productivity and NRM strategies. Renewed concerns of priorities of local needs, cost effectiveness and accountability of funds used on behalf of local communities strongly suggests reassessment of the traditional organization of extension service. The potential of farmer associations, private stockists and NGOs to facilitate technology development and transfer is not yet documented. Even though there are perennial calls to significantly expand small-scale irrigation projects, the factors resulting in their sustainable operation are not well understood, and examples of successful initiatives are rare.

Some key lessons synthesized from the policy research studies

One of the main limitations to effectiveness of NRM policy in the past has been failure to integrate natural, economic and governance components in formulating strategies. In many cases researchers have not adequately addressed the constraints likely to hamper implementation of their recommendations. The constraints which have led to low and declining use of fertilizers in the Highlands are not fully understood and fertilizer subsidies or liberalized input markets did not result in increased fertilizer use. Close to 60% of the farm gate price of fertilizer is explained by marketing cost. Poor roads increase transportation cost of fertilizer to levels well above those of much longer distances in a other countries. Fertilizer retailers are disadvantaged by lack of credit and information. Soil testing is needed to match fertilizer recommendations to the diverse soil conditions, yet it is not affordable by most farmers. Extension contact, motorable roads and formal education are significant factors in influencing adoption of maize, intensity of fertilizer use and in turn maize productivity. Yet the mandate for these joint inputs falls under three different ministries encouraging disjointed policies. Empirical evidence has shown that successful commercial production has a positive effect on both food crop productivity and soil fertility enhancing activities at farm level. Yet, some reforms destabilized commercial production in some areas and reduced fertilizer use leading to low maize productivity in general.

For successful community management of forest resources, the local community has to appreciate the value of the forest, own the resource, even if it is through co-ownership with the state, control its use, monitor and enforce regulations, have mechanisms of resolving

conflicts and discourage incentives to exploit it for short term individual gain. Success of small-scale irrigation projects is more likely if farmers are consulted in design, construction and management. Free riding on irrigation services is discouraged by penalties imposed by local committees, popularly elected and entrusted with the day to day management issues and is answerable to the community. A strong felt need by the local community appears to be a more effective incentive in precipitating successful initiatives than policy, particularly if farmers have control of resources needed and have a local institution with the required capacity for management. In scaling-up adoption of innovation, the role of researcher shifts to one of facilitating farmers to actually see the technology at work, to experiment with it, and choose technologies options for themselves.

The review prioritized key gaps for further policy research as follows: (1) Identify ways of integrating natural, economic and governance components in research for NRM policy problems. (2) Identify cost effective ways of implementing research recommendations so that policy makers are confronted not only with the constraints but also with tangible "ways forward" to reducing them. (3) Concerns of soil fertility and crop productivity need to prompt further research on options for exploiting intra-zonal variation in crop productivity to ensure that farmers with below average yield increase it to the average level. (4) Identifying farmer based institutions to provide services previously provided by the public sector. (5) Facilitating profitable participation of the private sector in providing the goods and services needed to earn sustainable livelihoods from NR. (6) Harnessing the synergies from production of commercial crops and articulating the positive commercial production spillover to NRM particularly at farm level.

Small-scale irrigation as part of NRM strategy needs further research to facilitate tapping local knowledge in all phases of the project and to prevent fragmentation of project responsibility. Research is needed to provide information on irrigation-based farming systems, related to crop water requirements, agronomic and agricultural engineering concerns, because irrigation as part of NRM has social as well as engineering components and an irrigation project is only one contribution to the livelihood systems of farmers.

Adoption of technology and practices to halt or even reverse land degradation are not only determined by the ability of the farmers and their resource endowment, but also by their awareness of the degradation, the knowledge of what measures requires to be taken, and the incentive to initiate them. However the relative importance of these factors as constraints to the adoption process is an empirical issue depending on specific circumstances. The most limiting among the four components can only be determined empirically. Similarly it is conventionally held that trees are owned by the land owner and farmers holding land rights use more formal and informal credit. Some evidence suggests otherwise and more research is needed to determine if this is widespread in the Highlands. In management of forest and tree resources it is not clear how common property management by local communities can be made more effective. Further research is needed to determined ways of identifying and increasing stakeholder participation in NRM concerns and attracting more research to cover non-mainstream issues of the ecosystem such as issues of integrated soil fertility management.

The main challenge in scaling-up innovation is that it takes time and patience on the part of researcher to allow farmers to experiment on their own. It is not clear how the process can be speeded up and how similar experiences can be shared more effectively among researchers. Research is lacking on how facts, relationships and institutional arrangements of NRM, informed from experiences around the world, can be presented widely to local people in a user friendly manner. Increased investment in NRM policy research needs to be attracted by identifying methodologies that can compare the return to investment in NRM research relative to those obtained from other alternatives. Finally the capacity in NRM policy research needs refocusing by addressing knowledge and skills not taught in the traditional training of policy researchers and re-tooling as new methodologies emerge and technology applicable in research advances.

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I INTRODUCTION

1.1 Natural resource management issues in regional and international

It is estimate that 646 million people live in Sub-Saharan Africa (SSA). Among them 61% depend on agriculture and 34% are undernourished. (FAO, 2001[1]). In 1977-1997 period agricultural production increased by 2.7% annually, but the population growth in the last three decades was 2.4-2.9% per year (FAO, 2002[2]). Food production in the region has not kept pace with population growth rate, making it the only region in the world with declining per capita agricultural production and per capita food consumption. The disparity raises further concern because increase in the world food production in 1950-1989 was realized from increased use of fertilizer, but most of the increases in agricultural output in SSA were from area expansion rather than increase in productivity (Townsend, 1999).

Rapid population increase on limited land in SSA has prompted methods of production that mine the natural resource leading to soil degradation and in turn to low productivity. Population pressure has also lead to cultivation of marginal and fragile lands, encroachment of forests and water catchment areas, leading to forest degradation, deforestation and conflict in use of natural resources between people and wildlife. The bulk of agricultural production in the region is rain fed and soils are generally of low inherent fertility compounding the problem of low agricultural productivity (Heisey and Mwangi, 1996). In fact SSA leads the world with the highest proportion of soils with fertility limitations (El-Ashry, 1992). By the year 2020, if the current trends are not reversed, Africa will have the world's largest net deficit in cereals, both in absolute and in relative terms (Heisey and Mwangi, 1996).

Nutrient mining is a serious problem in many SSA countries because nutrient removal exceeds nutrient replenishment by a factor of three to four making (Bumb and Baanante, 1996). The commonly recognized forms of soil degradation are: erosion (physical, chemical and biological), chemical degradation, biological degradation (losss of soil organic matter and biodiversity), salinization and pollution (Gachene and Kimaru, 2003)

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[1] Food and Agriculture Organization of the United Nations (FAO) 2001. Global forest resources assessment 2000, Main Report. FAO Forestry Paper No. 140. FAO, Rome, 479p.

[2] Food and Agriculture Organization of the United Nations (FAO) 2000 The state of food insecurity in the world. FAO, Rome.

They reduce agricultural incomes and economic growth. Since the poor depend heavily on agricultural production, they are most vulnerable to negative effects of soil degradation. Furthermore, annual crops-the bulk of cultivation by the poor-degrade soil more than perennial crops. The poor also depend to a considerable extent on common property land and natural resources which are more prone to degradation than privately managed natural resources. The poor also inherently lack the capacity to make land improving investments which in turn entrenches them further in their poverty. Thus, a vicious cycle of poverty more aptly described as degradation-poverty trap, ensues (UNEP, 1995; Scherr, 1999).

The Green Revolution, widespread in Asia and in some countries of South America, and heralded as the technology package that enabled the world to achieve food security in the last half of the 20th century eluded SSA. The linchpins of the Green Revolution were use of improved high yielding varieties, inorganic fertilizers and in some regions, irrigation. Fertilizer use in SSA relative to other developing countries illustrates vividly the extent to which the region missed the Green Revolution. In 1994, fertilizer use in SSA was only one fifth off the rates used by other developing countries. This level was low even after allowing for inter-country variations and that rainfed agriculture dominates in the region (Townsend, 1999). In 1993 on the average, African farmers used 10 kgs of inorganic fertilizer compared to 83 kg per hectare for all developing countries and the amounts were decreasing ─ in 1995, African farmers used 9 kgs of fertilizer per hectare and even manure was in short supply (Reardon et al., 1999; Heisey and Mwangi, 1996).

Therefore, continued food insecurity in SSA, stagnating development and in some countries erosion of the development gains already made, is a manifestation of production methods made unsustainable by population growth, nutrient mining and scarcity of alternative land. These factors have not operated in isolation: social institutions and governance have not responded adequately to these constraints. The result is widespread and increasing poverty accompanied by degraded natural resources in SSA. In fact, areas which were naturally endowed with adequate rainfall as well as rich and productive natural resources such as the East African Highlands, have not been spared.

2.2 Natural resource management issues in national context

The East African Highlands are those areas 1400 meters above sea level found in Kenya, Uganda Tanzania and Ethiopia and 1200meters above sea level in Madagascar. The focus of this study is these highlands in Kenya, Uganda and Tanzania. In Kenya the highlands occupy 18 % of the land and support 64% of the population while in Uganda and Tanzania they constitute 28% and 10% of the land area and support 38% and 49% of the total population respectively (Alumira and Awiti 2000). The Highlands have high annual rainfall with two growing seasons and productive soils: their agricultural potential is relative to the neighbouring marginal areas. However, traditional natural resource management practices such as natural fallow are faced out by population pressure on land. Inorganic fertilizers are increasingly unaffordable and acidity problems arise with their regular use. The result is wide spread poverty and degraded natural resources. The area is plagued with continuous cropping that mine soil of nutrients resulting in declining soil fertility- the capacity of soil to support plant growth on sustained basis, yielding quantities of expected products that are close to the known potential (Gachene and Kimaru, 2003). Soil erosion, recurring pests and diseases limit agricultural productivity even further. Subdivision of land into progressively smaller units, deforestation and declining wood and forest resources as well lack of feed for livestock threaten sustainable livelihood strategies in the area.

These situations in each of these countries were compounded by reforms which started in the early 1980s aimed at restructuring the economy to allow more market-allocation of resources than in the previous periods. Subsidies to agriculture and basic services such as health and education were reduced drastically or even withdrawn altogether. User-fees were charge for these services constraining the income available to households. Disruption of co-operatives, closing down of parastatals which used to market produce for smallholders and falling prices for agricultural commodities in the world markets, reduced cash income from farming constraining expenditure on inputs even further. During the same period the three countries underwent radical changes in the political arena which diverted attention from the natural resource management issues at farmer level. However some of these conflicts could be trace at least in part to underlying issues of natural resource access and use.

Therefore the challenge, at the beginning of the twenty first century, that the Highlands pose to researchers, farmers, government and other stakeholders is to device ways of increasing agricultural productivity in a manner that is compatible with sustainable resource use. The resources are not just soils but also complementing resources particularly forests, biodiversity, water and wildlife. The challenge is compounded by the complexity of natural resource management and the diversity of the ecology and the farming systems that have evolved in the area.

1.3 Objectives of the study

Knowledgeable observers describe poverty and environmental degradation as symptoms of malfunctioning systems which have lost their resilience (UNEP, 1995). Both involve human beings as managers of natural resources (the environment) and the beneficially of the resulting prosperity (or poverty) and hence the focus of this study is natural resource management policy problems in the highland of Kenya, Uganda and Tanzania. The objective of the study is to review natural resource management policy research studies in the three countries to; determine the key policy problems related to natural resource management, synthesize key lessons from the studies, list major institutions in the region with capacity in NRN policy research and to prioritize key gaps and second generation research questions. The results anticipated from this review will contribute in informing policy makers, researchers, practitioners, non-governmental organizations and other stake holders in natural resource management for improved and sustainable livelihoods in the Highlands of the three countries.

1.4 Natural resource management (NRM) problems in the local context

Despite the general common problems outlined above, the three countries in East Africa have important differences not only in the physical endowment but also in historical setting, socio-economic conditions, institutions and policies which have impacted on agriculture and natural resource use and management to date.

1.4.1 Kenya

In the Central Highlands of Kenya, some smallholders were growing coffee as early as 1950s on meticulously constructed terraces complete with a strip of grass on the outer edge1[3]. Farmers failing to maintain them were barred from delivering their coffee to the factory. Similar regulation prohibited cultivation on very steep slope and on close to river banks: they were enforced and observed. In 1963 when Kenya became independent from British colonial rule, the verbally articulated policy was that the major task ahead was to eradicate disease, lack of education and poverty. Land ownership was considered one of the key inputs in eradicating poverty. However many of the NRM practices of the colonial period such as terraces simply disappeared with lack of enforcement. In general the economy was performing well because it achieved an annual economic growth rate of 6.6% from independence until the 1970s. However the average annual growth rate in 1974-79 was 5.2%, declining to 2.5% during 1990-95 and eventually to -0.3% in 2000.

Agriculture drives the economy because it explains 45% of its growth pattern while 35% and 20% is explained by tourism and the service sector respectively. However increasing poverty in rural areas is still the main problem after 40 years of independence even in the Highlands. Declining agricultural productivity and degradation of natural resource in the country as a whole and in the Highlands in particular, is attributed to poor or ineffective policy implementation (Omiti and Obunde, 2002). In fact, Kenya has not been short of policies focusing on agriculture. For example in the post independence period apparently relevant policies such as; natural resources management and conservation policy, cooperative and agricultural development policy, soil and water conservation policy, land subdivision policy, allocation of forest land to individuals policy and food self-sufficiency and food security policy (Mwangi, 1999) have been formulated. In fact Kenya is said to be famous for its well articulated policy papers (Wolfenson, 2004[4]). None-the-less the policies are deemed to have failed. The factors linking policy failure to low agricultural productivity and in turn poverty are summarized as: lack of stakeholders involvement in decisions that affect them, poor link between planning and budget allocation resulting in

[3] The author remembers growing up on farm with such terraces in Tetu, Nyeri, Kenya
[4] Key note address of Tegemeo Institute, Egerton University

under funding of key sectors like agriculture, and a liberalization process that is not comprehensively thought through.

1.4.2 Uganda

Uganda like the other East African countries attained independence in 1961 inheriting the colonial rules, regulations and infrastructure impacting on agriculture and NRM such as research and extension services. These institutions retained their basic function until 1966 when the country became politically unstable. Consequently the colonial rules with impact on NRM and enforced by chiefs with stiff penalties such as prohibition of cultivating on steep slopes and on the river banks, were abandoned. However, introduction of new technology such as improved seed and fertilizer ensured increased production until 1970. But in 1971 the military government ordered Ugandans of Asian origin to leave the country. The move resulted in breakdown of the distribution system for agricultural inputs, processing and marketing infrastructure of crops like coffee and cotton. The agricultural extension system run by Government collapsed from lack of payment as the entire economy degenerated owing go down to break down in law and order (Egulu and Ebanyat, 2000).

1.4.3 Tanzania

Soil and water conservation practices have along history in Tanzania and although the research focused on semi arid areas of the country which occupies 50% of the total area, some of the observations by farmers on soil and water management (SWM) practices are instructive for similar practice in the highlands. First, the colonial period (1900-1961) was perceived by farmers as the must successful era for these practices (Hatibu et.al., 2004?). The farmers attributed the success to three factors: very strict laws stringently implemented, fear of the colonial government by the villager, and readily available education and extension advice to back the practices. Tanzania's post independent economic policy with impact on current NRM can be summarized by considering three main periods (Shechambo, 1999). State invention period (1961-75) was characterized by; increase in production of food staples and export crops, central control of agricultural commodities marketing, subsidized, centrally distributed inputs, rapid increase in social services and infrastructure, general improvement in the economy, increase in per capita

income and the launch of villagization program (Appendix 1). The economic crisis period 1976-85 was characterized by increase in production of food staples and their prices, but a decrease in export crops production and their prices. Subsidy of agricultural inputs as did their central distribution, but agricultural commodity markets were liberalized in later years. Rate of increase in social services and infrastructure started to decline including per capita income and general performance of the economy. The villagisation program started to decline. The period of economic reforms backed by donors was 1986-95. It was characterized by a decrease in real producer prices of food staples, and prompting increase in production to slow down. However, production of export crops increased in response to higher real prices. Markets and distribution of agricultural inputs were liberalized and their subsidies withdrawn. Since provision of social services and infrastructure declined, socio-economic hardships continued at household level, although per capita incomes increased. Villagization program came to an end.

In all the three periods, population growth was high starting at 3.3% and declining to 2.8% and agricultural technology was low (Shechambo, 1999). Taking mainland Tanzania, only 10% of land area is cultivated; 42% is under forests and woodlands while 20% is under grassland and scrub land. The miombo woodland make up 93% of the total forest area while 6 percent is natural high forests. Protected areas form 26% of the land area and the remaining land does not have specific land use plan. Agricultural extensification driven by population pressure in densely populated areas is a threat to the adjoining protected lands (Shechambo, 1999).

2 KEY NATURAL RESOURCE MANAGEMENT POLICY PROBLEMS

2.1 Sustainable agriculture

The long term goal of satisfying human needs from such as food, fiber and fuels among others, from natural resources, is viewed as the ultimate objective of sustainable use and management of resources in SSA. But the objective can only be achieved if the natural resource base and environmental quality is improved and enhanced, non renewable resources are used in an efficient manner, and economic viability of agricultural system is increased by utilizing natural biological systems and controls. The combined effects would be better quality of life for agricultural resource users and the society at large (FAO, 1998)

According to Pretty (1995) sustainable agriculture means different thing to different people because assessment of relative sustainability are socially constructed. However, sustainable agriculture can be viewed as any system of food and fibre production, whose major challenge is to make better use of internal resources (natural control processes and resources). This is achieved by minimizing the external input use, by regenerating internal resources more effectively or by a combination of both. It achieves this end by systematically pursuing the following objectives

- Incorporating natural process into agricultural processes such as nutrient recycling, pest-predator relationships, nitrogen-fixing crops, use of manure and composting
- Facilitating greater productive use of biological and genetic potential of plant and animal species
- Reducing external, off-farm, non-renewable inputs that cause greatest harm to the environment.
- Targeting more socially-just agriculture by increasingly equitable access to productive resources and opportunities.
- Ensuring more application of local acknowledge and practices.
- Facilitating increased self-reliance among farmers and local people.
- Ensuring long-term sustainability of current production levels by readjusting cropping patterns to climatic, physical and productive potential constraints.

- Targeting profitability and efficiency in production through integrated farm management (by- products or wastes from one enterprise becomes and input into another) which also conserves soil, water, energy and biological resources.

In total, these components result in integrated management meaning that resources are used more efficiently and effectively and negative impact on the environment is reduced. In sum, Pretty (1995) underscores that

> *"Agriculture can only be persistent and sustainable when resource-conserving technologies are developed and used by local institutions and groups, who are supported by external research, extension and development institutions acting in an enabling way. For sustainable agriculture to spread, the wider policy environment must too be enabling" p.21*

2.2 SOILS

2.2.1 Soil fertility

Soil fertility is a key concern in sustainable use of agricultural land. It is defined as the capacity of soil to support plant growth on sustained basis, yielding quantities of expected products that are close to the known potential (Gachene and, Kimaru, (2003). Loss or decline in soil fertility is closely linked with human activity. In general, African soils suffer physical loss from erosion, nutrient deficiency, low organic matter, aluminum and iron toxicity, acidity, crusting and moisture stress. Land management practices are to blame for causing some of these problems and exacerbating those that are inherent in tropical soils (Place et al., 2003). According to FAO, (1998), human induced degradation can be divided into four main categories that: water erosion which removes the productive topsoil and may eventually lead to gullies; wind erosion which is more common in arid and semiarid areas where vegetative cover is lost through overgrazing or through land preparation; chemical deterioration (loss of nutrients including loss of organic matter, salinization, pollution and acidification); and physical deterioration caused by compaction, crusting, sealing, waterlogging, and subsidence of peat soils. These constituents of soil degradation can be considered basic because Gachene and, Kimaru, (2003) include only a few additions to those listed above as recognized forms of soil degradation. These are erosion (physical, chemical and biological) causing physical

degradation, pollution, chemical degradation (salinization, sodication, acidification and, decreased plant nutrient) and biological degradation (loss of soil organic matter and biodiversity). These in turn influence physical properties and plant nutrients.

Land degradation and declining soil fertility was a concern for the governments even during the colonial period when all indigenous soil conservation measures were sidelined and foreign ones imposed by bureaucratic measures ignoring farmers needs (Pretty, 1996). In general, objectives of good soil and water management is to; increase availability of water to plants through increased infiltration of rain water; increase water holding and storage capacity; minimize soil loss, salinization and evapotranspiration from the soil. The specific measures used to conserve water will also achieve these objectives and they include: runoff water harvesting, crop rotation with deep rooted crops to utilize water at lower soil horizons, surface mulching, cover-cropping to decrease evapotranspiration; improved tillage to increase infiltration, use of fertilizers and organic manure to increase crop growth and use of drought resistance varieties in drier areas (Gachene and Kimaru, 2003). Land degradation and declining soil fertility is therefore a major challenge in sustainable use of natural resources in agriculture.

The wider challenge is one of making better use of available biophysical and human resources by minimizing the use of external inputs, by optimising the use of external resources, or by a combination of both. In this way efficient and effective use of what is available is ensured and any improvements made will persist, because dependencies on external systems are kept to a reasonable minimum (Pretty, 1995). Experience in the Highlands over the last three decades or so has shown that sustainable use of external inputs is constrained by socio-economic and technical factors and has prompted search for alternative and complementing practices. Some of the main components of these practices are described in the following section.

2.2.2 Integrating Soil Fertility Management

Place, et al., (2003) describe integrated soil fertility management (ISFM) as expanding the choice available to farmers by increasing their awareness of the options and how they complement or substitute with one another. These relationships underscore that both organic and mineral inputs are needed and none of them can be entirely substituted by the other in sustainable crop production. Main organic soil fertility practices in SSA are listed as: animal manure, compost, crop residue, natural fallow, improved fallow, intercropping systems, relay cropping systems, dual purpose legumes and biomass transfer. Gachene, Kimaru (2003) also note that integrated soil fertility management consists of simultaneous attention to the following three issues: (1) all land activities on cultivated land from land preparation to harvesting. (2) Water management along side nutrient management, and (3) Availability and use of fertilizers.

There is need to determine the complementarities of, and synergies between organic and mineral nutrients inputs and whether such complementarities if they exist, can increase market activity and demand for purchased inputs (Place et al., 2003). This view is supported by Gachene and Kimaru (2003) because they underscore that farmers are unable to increase productivity significantly using only manures available locally for the following reasons: low biomass production due to declining soil fertility and inadequate as well as erratic rainfall; little available organic material to decompost or incorporate into the soil directly; reduce rate of accumulation of organic matter by very rapid mineralization in prevailing hot climates; consumption of a lot of organic matter by termites in some areas, and use of most of the stover as livestock feed without returning the manure to the original farm. Continuous cropping in these circumstances leads to soil mining and fertility decline. A significant increase in use of organic and inorganic fertilizers would be needed for significant increases in land productivity. In addition to these constraints increased use of organics is further limited by its bulkiness and seasonal availability (Place, et al., 2003).

2.2.3 Soil and water management technologies

Water and soil fertility are the main limiting factors in crop production but most soil and water management technologies are labour intensive. Consequently, their use is likely to have different implication in terms of additional labour requirements, labour timing and

returns, for different social group, such men, women, old people and the young. These implications require evaluation before implementation and scaling-up of these technologies (Kronen, 1994). The wider concern is that the link between sustainable NRM and social economic characteristics of households is not clearly understood. For example, the relative contribution to degrading land and investing in land fertility improvement among households of different resource endowment is not clear implying that the interaction of people with technology and how those interactions become potential causes of degradation call for empirical evidence. A study of farmers in Uluguru, Tanzania, pointed out that since the poorest migrate to look for jobs their land located on the steep slope had longer fallow period and hence was less degraded. The poorest also let out low lying (more productive land) near irrigation facilities to the more wealthy for vegetable production, which inherently received more fertilizer input than maize grown by poor farmers (Jones, 2002).

However, soil fertility maintenance practices are limited not only by ability but also by perception, knowledge and incentives to farmers (Jones, 2002). For example, most of the farmers in Uluguru considered fertility decline a significant problem, but a strong perception that erosion was a problem was lacking, even though compensatory measures were common in the area. It was therefore concluded practices that that increase soil fertility were more likely to be adopted than erosion control practices. The study found that farmers were not limited by knowledge because they knew more measures to stop fertility decline than they were able to implement. In this area, incentive for agricultural production and soil conservation appeared to be competing with that of earning off- farm income.

It appears the some local knowledge can inform development of efficient soil and water management technologies. For example in Southern Tanzania hillsides, the Ngoro System is used to maintain soil fertility and to control soil erosion. It consists of a series of small pits and heaps used alternatively such that wheat, maize and beans are planted in the pits in the first year, and in the heaps the second year, and the cycle is repeated. Soil fertility is maintained because crop residues and weeds are thrown into the pits, and soil erosion is

also controlled because water over flow from one pit is trapped by the next pit. Another innovative possibility meriting further research is that of modifying tillage practice such as tied-riding and the amount of input such as the amount of fertilizer applied, depending on dry or wet years. The target would be to increase yield in wet years and reduce loss on inputs in dry years (Kronen, 1994).

2.2.4 Land fallowing

Griesly, and Mwesigwa (1994) noted that studies on soil-fertility management issues in economic context, with the exception of adoption of soil conservation practices, are lacking. Consequently commonly held notions are not challenged and corrected to inform policy. Their study gives empirical evidence that the commonly held view that fallow period will decrease with increase in population, did not hold for the survey farmers on steeply sloped Kabale area of south-western Uganda/ during the second season of 1991. They hypothesized that the variation in the percent of household's cropland fallowed in current season is explained by variation in the field size at homestead location, acres per household member, acres per adult worker in household, percent of cultivated land intercropped, days per week wife works off-farm, percent of land on hillsides and homestead-field distance in kilometers. The policy lesson emerging from the study was that there can be situations where increased population densities prompt households to engage in more land and labour intensive production technologies such as intercropping, and continue fallowing for soil loss and fertility management. The implication is that a possible workable short-term strategy of facilitating farmers access to intercropping technologies, which allows them to continue with fallowing for soil fertility management practices under decreasing land/population ration. Alternatives such as chemical fertilizers or terracing may be too capital or labour intensive for the farmer.

2.2.5 Green manure

Use of green manure is another relatively less researched soil fertility management practice likely to be informed by local knowledge. For example, a study of Kwalei Village in Tanzania, one of the Africa Highlands Initiative (AHI), was promoted by the observation that farmers were aware that land productivity in their village was limited by soil fertility, fertilizers were available but unaffordable, the little amount used was lost through run-off

on steep slopes, but only few farmers used leaves from locally available shrubs as green manure to improve soil fertility (Wickama and Mowo, 2001). The study tested the chemical composition, effect on soils and mineralization of plants identified by farmers as effective sources of green manure in participatory research. The study found that a large number of farmers become interested in experimenting with green manure, making compost and enriching it with rock phosphate because they were involve in the investigation right from start. This is yet additional evidence that researchers have some leeway in facilitating action by farmers without waiting for policy change, by careful selection of research methodology and the objectives of specific projects. Lack of information on indigenous shrubs used for green manure in other areas in the Highlands suggests that an inventory needs to be made. It is also not clear how the two shrubs found superior for green manure in this study would perform in other comparable areas.

2.3 IRRIGATION AND WATER HARVESTING

2.3.1 Water harvesting

According to Gowing et al., (1993), one of the key opportunities for attaining food security is irrigated agriculture but many irrigation systems perform below their potential, unresolved salinisation and water logging problems make the practice sustainable, even as the competition for water for cities and industrial use keeps on mounting. Sustainable use and opportunity cost of water are therefore the contentious issues in irrigation because the need for it is undisputed. Irrigation issues in agriculture would be by their nature closely linked with water harvesting technologies (WHT). This is not the case because water harvesting technologies and concerns appear to "get lost" in the traditional issues of soil and water management. Gowing et al., (1993), define water harvesting as the local collection, concentration and conservation of rainfall runoff for agricultural production. Young et al., (2002) add that this is done by linking a runoff-producing area (RPA) with a separate runoff- receiving area (RRA). Others define it as a continuum of techniques, from traditional irrigation to in-situ groundwater conservation, whose objective is to collect rainfall run-off for cultivation. It appears there is merit in including water harvesting as some sort of irrigation. Lack of technical knowledge is singled out as the main factor hampering RWH in Tanzania (Young et al., 2002) and the available literature does not

given any evidence that the situation is different in the other areas of East Africa where water for agriculture is a constraint. This means that farmers and extension workers do not have ways of determining, among the ones available, the WHT best suited to the specific field and to the livelihood strategies of the farmer. The suitability is determined by an interaction of components such as crop, soil, climate, topography, farmer's management factor.

Water harvesting technologies seem to focus on semi arid areas but water availability is also a limiting factor in crop and livestock production in the Highland. The farmers with access to land at the bottom of the landscape enjoy off season crops particular vegetables, maize including fodder crops exploiting the natural concentration of rain water and nutrients carried from the surrounding areas in to the valley. The same thing happens in semiarid areas. Hatibu (2004) notes three distinct rainwater harvesting methods in semi arid areas: capturing rain water where it falls and encouraging infiltration in to the soil through practices such as ridging; collection and concentration and/or diversion of runoff into crop fields through catchment systems; and collection and storage of runoff for late use in crop fields. The last two require extra land which is a major constraint in the highland.

Lessons for future policy research on water harvesting from this paper are the following. (1) Investigate indigenous water harvesting practice in the highlands because previous work is concentrated in the semi-arid areas (2) Identify the water harvesting practices of the semi-arid areas that can be adapted to specific areas in the Highlands (3) Develop the methodology for guiding the choice of the technique that best fit specific site (Gowing et al., 2004).

2.3.2 Mwea irrigation scheme

According to Nguyo and Bezuneh (2000), Mwea irrigation scheme (MIS) is the largest and most efficient irrigation scheme in Kenya. It was started in 1950 to settle the landless and unemployed particularly ex-detainees of the struggle that resulted in independence in the country. The land is owned by the national irrigation board and the farmers are tenants

cultivating on lease as per the direction of the board. In 1999 the crisis which has simmering over farmers' dissatisfaction with their lack of say in rice production and sharing the benefits with NIB came to a head in 1999. The farmers refused to deliver the paddy to NIB which had no other way of recovering the costs of services rendered to farmers such seed production, mechanical rotavation, pesticides, drying facilities and maintenance of irrigation infrastructure and road. In this rice production system manual labour is the only input by the farmer. The NIB determine the price of paddy unilaterally, recovers the costs of services and inputs from the revenue and gives the balance to the farmer. Land is not owned by the farmer and the lease can only be inherited by one son. The children of the lease hold on attaining the age of 18 years are supposed to move out of the NIB villages housing the lessee. These form the bulk of the population in the area growing rice by illegal tapping of the irrigation water. The population in the area has grown against a fixed set of resources with negligible alternatives to earn livelihood other than farming rice.

In view of the general principles important in sustainable NRM using local communities as articulated in the available literature, and examples of successful NRM by local communities, the conflict afflicting MIS were to be expected. It is surprising that they did come any earlier because. Moreover the initial conditions which made the lessees compliant over a period close to half a century have drastically changed if they have not ceased altogether

2.3.3 What factors have contributed to the widespread failure of small-scale irrigation projects in the Highlands?

It is acknowledged that irrigated agriculture is one of the key options for attaining food security, even as competition for water between agriculture and urban use increases (Gowing et al undated). This is because irrigation is one of the means of increasing agricultural productivity by harnessing synergies of natural resources (Thompson, 1991). The key issue in not whether irrigation is needed but whether it can be made more sustainable and water use in agriculture can justify its opportunity cost (Gowing et al undated). Thompson (1991) cites literature asserting that in general small-scale irrigation

systems operated by farmers have been shown to be less costly and more effective than large scale centrally managed irrigation systems, in terms of agro-ecological, economic and social-cultural considerations. Therefore, the government of Kenya is keen to foster development of small-scale irrigation systems, in order to exploit at least part of the irrigation potential of about 350,000-540,000 hectares. But as summarized by Thompson (1991) attempts at small-scale irrigation systems have yielded limited success because:

- Irrigation system design, construction and management are seen as solely technical/engineering problems. Therefore, insights of local practitioners including, traditional and local knowledge are ignored in planning, developing and managing the irrigation schemes. Farmers are only involved at the operation and maintenance stages.
- Project design follows a standardized process of solving technical problems which preclude talking to farmers and refining project design to meet local needs.
- Project design, construction, operation and monitoring are viewed as separate activities which can even be done by different units in the ministry. In this set-up, the potential role played by local water-user institutions in integrating these and other activities of irrigation system is totally ignored.
- Project designers fail to acknowledge and be influenced in their design by the fact that irrigation will be one among other activities carried out by farmers. Therefore it may generate new constraints or exasperate new ones. In the case of the NGK small-scale irrigation stated earlier, labour was already a constraint and it continued to be after the implementation of the irrigation facility. Access to water caused over production and generated marketing. In the past, planners of innovations took the general view that farmers will adjust their social organizations and resource management options to the requirement of the new technical system. This did not happen in the NGK case.

It is clear that the insights given by these shortcomings of a small-scale irrigation system can be adapted for use in planning effective management of other natural resources.

Even though crop production is limited less by water in the Highland relative to semi-arid areas, farmers with access to water in the Highlands grow high value crop particularly

during-off season when the prices are high. In the central Highland of Kenya for example, milk production is limited by availability of fodder during the dry season. Since the milk market was liberalized the farm-gate price of milk varies with the season. These observations suggest that some form of irrigation is needed and seem to support the idea of expanding the definition of irrigation needs to be expanded to include water harvesting. This is the local collection, concentration and conservation of rainfall runoff for agricultural production (Gowing , et. al, undated). Water harvesting is well documented for semi-arid areas (Young, et.al, 2002: Kronen, 1994; Gowing , et.al, undated) but rare in the Highlands with the exception of rainwater storage for domestic use (Nega and Kimeu 2002). Since farm sizes in the Highlands will continue to decrease, alternatives have to be found for increasing productivity per unit area. Therefore there is need to; investigate indigenous water harvesting practices in the Highlands, identify the water harvesting practices of the semi-arid areas that can be adapted to specific areas in the Highlands and develop the methodology for guiding the choice of the technique that best fit specific site.

2.4 MANAGEMENT OF FORESTS AND TREE RESOURCES

2.4.1 Overview

The world's forest area is estimated at 650 million hectares. Africa holds, 17% of these resources mainly as tropical forests. The net change of -0.78% in forest area annually in Africa or loss of 5.3 million hectares per year is the highest globally. East Africa contains 23% of the forest found in Africa (FAO, 2001). However, most of the natural forest estate in not under any known management plan, although it supports the bulk of human and animal population in the area, and is one of the linchpins of economic development (Kosero, 2003).

According to Kosero (2003) as the population of people and livestock has increased pressure on limited forest resources has mounted causing and intensifying the following negative effects:

- overexploitation of the forests for both commercial and household products,
- excision of forests for cropland.
- overgrazing in forests, woodland and grasslands

- unsustainable draining of nutrients from forest,
- intensified soil erosion, accelerated water run-off, and increased siltation of rivers and dams, among other negative adverse effects.
- aggravated and unsustainable use of forest resource in the area from fires, urbanization, mining, road infrastructure, droughts, floods, settlements for migrating people, and conflicts
- forest degradation from selective commercial timber logging and deforestation from the infrastructure that supports and accompanies. *(Kowero, 2003 p.2)*

The combined effect results in increased hunger, poverty and environmental degradation which appear to have prompted a change in the approach to forest management in the region. It is increasingly acknowledged that forest resources in SSA is a primary component in rural development since forests are part and parcel of economic, social, cultural and spiritual realities in the area. The urban population also draws on forest resources directly or indirectly through commodities such a water, hydroelectric power, fuelwood, food, construction timber, and furniture (Kosero, 2003). For example in Kenya, 22%, 92% and 4% of urban households used firewood, charcoal and agricultural residues respectively for fuel (Yang, 1999).

The colonial and post colonial natural forest management in Africa and many parts of the developing countries were based on the notion that forests have to be protected from people (Wily and Haule, 1995). But management of forests in SSA is slowing shifting from the centralised state-driven management inherited from the colonial period and maintained almost intact for the last several decades by independent governments, to one that is decentralised and people driven, through involvement of communities and the private sector. This process of making forest management people-centered rather than tree or forest centered as in the past though appealing is has yet to materialised for the larger proportion of forest resources in the area (Kosero, 2003). The revised approach to forest management will evolve depending on the social-economic, historical, political, and legal conditions specific to each of the three countries even though common features will appear as shown by the following examples

2.3.2 New approaches to forest management

One of the ways of articulating the revised approach to forest management has been through "national forest programmes" Tanzania is singled out as one of few countries where the national forest programme had the greatest positive effect (Mayers, 2003). "National forest programme'' refers to a wide range of approaches to the process of planning, programming and implementation of forest activities in a country to be applied at national and sub-nation levels, based on a common set of guiding principles. The objective is to establish a workable social and political framework for the conservation, management and sustainable development of all types of forests. This is in turn will increase the effectiveness and efficiency of public and private operational and funding commitments. They therefore require a broad inter-sectoral approach at all stages, including the formulation of policies, strategies and courses of action, as well as their implemenatation, monitoring and evaluation (FAO, 2003[5] cited by Mayers 2003).

In the past, internationally driven calls for forest sector plans have achieved limited success because they were simply exercises on paper which were quickly shelved as soon as donor support came to an end. To avoid this pitfall, Mayer (2003) suggests that national forest programmes has to address the political and economic realities of the specific country with a view to identifying what needs changing, how it can be changed and how the change can be made more sustainable. In this manner they can also be used to develop good governance which is vital in making access to natural resource contribute to poverty reduction.

2.3.2 Forest management in Uganda.

In Uganda, the new approach to forest management can be covered under the 1995 constitution which gave local councils the power and authority to plan and manage the local natural resources in their areas. The act established local committees/councils to govern natural resources. Local governments were given the legal authority to establish and manage small forests on public land for the needs of the people. Land registration and

[5] FAO 2003. National forest programmes. Website http:/www/fao/org/forestry/foris/

management of communal land as common property is also facilitated under the 1998 Land Act which stipulates that where any group of persons hold land communally, the land may be held on behalf of the group by a trustee chosen by the group, according to the customs of such a community (Gombya-Ssembajjwe and Banana, 2000) The forms of community forest found in Uganda are:

- Local forest reserves managed by the local authorities for the benefit of the local people.
- State forest reserves under collaborative forest management.
- Private farmers growing and managing trees and/or forests on private or hired public land.
- Local communities managing small local forests of historical and /or cultural value

Some major changes that have been made in forest management in Uganda as follows: (1) Change in forest policy has been done to allow for the participation of local communities in the management of forest reserves (2) At all levels of its operation, the Forest Department has institutionalized community forestry within its operations (3) Capacity of staff at all levels is being strengthened to be competent in handling community forestry. (4) Forty percent of the revenue collected from forest resources within a sub-county by the Forest Department is given back to the community as incentives (Gombya-Ssembajjwe and Banana, 2000)

The reasons the local community in Butto-Buvuma used to justify participation in community-based forests management are likely to be inspired by widespread problems of assessing forest resources in Uganda and in the Highlands in general. They were stated as: mismanagement of the forest; high level corruption among forest managers; preferential treatment in favor of outsiders relative to the local people in access to forest resources; and direct financial benefits from the forest were not seen by the local people (Gombya-Ssembajjwe and Banana, 2000). The following factors were also identified as constraints to community forest management (CFM):

- There is no legal framework supporting collaborative management of forest reserves because the Forest Act does not specifically state the role of communities in the management of the forest estate in Uganda.
- Government policy is to transfer management responsibility to the community but the local people prefer to own and manage the forests as a community.
- Some policies of the Government conflict. For example, increased agricultural production stressed in the liberalization policy prompts clearing of forests for cultivation because inputs such as fertilizer for intensive production on the available land are not accessible.
- The poor in the community have no other alternative of generating income other than harvesting forest resources. In these situations regulating yield to sustainable levels is difficult if not outright impossible.
- Most of the personnel from the Ministry were trained in the traditional method of managing forests and they lack the skills, and appreciation of CFM methodology.
- Participating individuals and communities have not seen tangible benefits from CFM because: these resources were seriously degraded and they are not currently producing meaningful revenue. 'Free riding' is a major problem in meeting the cost of CFM activities.
- Some politically powerful individual influence the management committees and other governments institutions such as the police and the army do interfere with CFM for their benefits.

The evolution of community based forest management in Tanzania offers suggestion on how some of these problems can be solved.

2.3.3 Forest management in Tanzania

Current forest resource management in Tanzania is unique among the East African countries for two main reasons. First, it is the only one among the seven countries in Southern Africa which constitute the ecoregion dominated by the miombo woodland. This is one of the most extensive dry forests vegetation in Africa occupying 2.7million square kilometres. Unsustainable use of miombo woodland emanate from increased human and livestock population pressure resulting in the problems of degraded forest resources cited

earlier. Second, in Tanzania unlike in the other two countries the "local community" is an entity in the form of a registered "village" with a legal and institutional base governed by an elected village council which can enact village bylaws respected by the courts. Each person belongs to a specific village (Alden –Wily et al., 2000). The village uses well defined tracts of land, consisting of privately-owned farms and communal land which often includes forests. The village is a corporate entity which can own, buy, sell and sue/be sued (Willy and Haule, 1995). This feature gives Tanzania a head start in community based forest management (CBFM). Their experiences and unique elements can inform similar strategies in the other two countries as illustrated by the case of the Duru-Haitemba CBFM. Duru-Haitemba is a forest area of 9,000 hectares which came under the CBFM in 1994 and the following features can be note:

- The system established for CBFM is such that the community can fully enforce their management regime and village bylaws in a manner that the courts will honour if the village authority is challenged.
- The rules established may exclude non-community members from accessing the forest.
- CBFM is a genuine attempt at truly devolving the forest authority and management to the local level. It is not an attempt to simply involve the local community in the Government management of the forest and somehow reward them for helping to protect the forest.
- By taking the view that community ownership of the forest represents the outstanding stake a community may have in the forest, CBFM handles the basic question of resource ownership. This represents a basic difference in the approaches based on Indian and Nepalese experiences where ownership of the forest by the community is not at the heart of the approach in management where local people take care of the forests that they use.
- CBFM is not reserved for degraded, small and least important forests. No forest is considered too large or too important that it cannot be considered for this approach.
- The community (people living next to the forest) own and are custodian to the forests and have the legal mandate to limit use of forest resources by outsiders.

- The new land policy encourages each village to secure formal survey and demarcation of their village land with a view to obtaining a title deed

2.3.4 Forest management in Kenya

In Kenya the poverty reduction strategy covering 2000-2003 period (Kenya, 2000) states that continued degradation of forests ecosystems has contributed to the poor long-term economic growth and social-political stability, with negative impacts on agriculture in general, public health, tourism, energy generation and timber-based industries and in turn livelihoods. To reverse this trend, ten strategies are stated. One of them is to involve stakeholders in local forest management and decision making and to draw collaborative agreements with communities, societies and advocacy groups. Mayer (2003) notes that since poverty reduction strategies (PRSs) is the current emphasis of aid agencies, they have become an important determinant of development agenda and in turn critical framework within which potential of forests to reduce poverty can be realized. The challenge is to ensure that a holistic view of forests and those who depend on them is taken.

2.2 POLICY AND RESEARCH IN NATURAL RESOURCE MANAGEMENT

2.2.1 Introduction

In order to appreciate the problems of NRM and relate them to policy there is need to articulate the constituents of NR, what their management entails and link them to agricultural production which is the dominant activity in the Highlands. Natural resources are not merely static biophysical entities but political as well as economic commodities, essentially dynamic and embedded in social as well as political setting. Human institutions in their broadest sense and available technology define resources and their use (USAID, 2002; and Omamo, 2003). NRM is a process consisting of decision making, planning, implementation and monitoring (USAID, 2002), and agriculture is a subset of NRM (USAID, 2002). Therefore appropriate NRM systems can only be developed if natural, economic, and governance components are appreciated and integrated. These are linchpins driving the process. In particular, appropriate NRM is derived by combining resource characteristics, policies, institutions, skills and economic signals (USAID, 2002). Therefore, limited success achieved with the past policies can be explained by failure to

integrates these components in strategies addressing NRM problems in the Highlands. For example, issues of governance and institutions at local level, where resource users and managers are found, are recent dimensions in NRM concerns.

2.2.2 What is policy in NRM context?

Policies are key ingredients in generating sustainable solution to NRM problems. But the available literature suggests that researchers have wide-ranging views on what constitutes policy, and consequently, the output deemed to be policy research also varies widely. The different unresolved, and in some case incompatible views, on what constitutes policy are likely to have contributed to reduced effectiveness of policies formulated to solve problems of low agricultural productivity, and to increase efficiency and effectiveness of NRM.

For example, although statements such as "there has been a lot of government policy change in the last decade in Kenya" or "reforms and liberalization need to be moved a stage further", components of policy are illusive. The problem of articulating what constitutes policy is not unique to researchers in the region. In an attempt to understand the policy process, Keeley and Scoones (1999) focused on the environmental policy process in developing countries, and used three models to illustrate different perceptions of what constitutes policy. The authors compared the task of understanding how knowledge becomes expressed as policy as an attempt to "prise open the black box of policy". Policy researchers are not the only group of people keen on understanding what constitutes policy. A politician quoted by Keeley and Scones (1999) is said to have compared policy to an elephant in the sense that, it is not easy to define but when you see it you know it.

Policy is generally defined as course of action adopted or prudent procedure[6]. It is also defined as a plan of action adopted or pursued by an individual, government, a party or a business[7]. In management of business firms, policy is defined as a guide to action. It suggests in general terms what mangers should do in different decision situations.

[6] Webster's Dictionary.
[7] Collins Dictionary of the English Language.

Managers must use their discretion in making decisions, because policies as guidelines or boundaries do not tell them exactly what to do[8].

The common theme emerging from these definitions is that policy is ultimately linked to action or it is indeed a plan for action. From an economic perspective, the link between policy and subsequent action is even more pronounced underscoring the role of research in policy. An economic policy analyst defined policy as a program of action adopted by government to deal with a problem, situation or phenomenon. Therefore, policy research is scientific inquiry into a problem or subject in order to develop a plan of action, based on observed facts. To do so policy, research must be relevant, topical, timely and reliable (Kimenyi, 2002).

Clearly, there is more to policy than just statements or recommendations devoid of subsequent plan of action. However a key problem in NRM policy formulation is that the overwhelming majority of policy research reports go no further than making recommendations in form of statements. A plan of action hardly features in the deliberation, and implementation is assumed to be automatic and problem free, or at best, well outside the concerns of the researcher. It is not clear if this is done as judicious caution pending additional evidence. Is noteworthy that issues of scaling-up technology adoption and collective action in NRM, which have increasingly gained importance, are actually addressing implementation concerns.

2.2.3 What is the nature of policy makers? Do they value and use empirical research input in formulating policy?

One of the key potential consumers of policy research findings and recommendations in agriculture and NRM is the policy maker. Therefore researchers are encouraged to target them in "marketing" their research findings. However, the nature of policy makers and the environment within which they operates is not well understood. The sources of information they use to formulate policy are also not clear. Policy makers are said to have a short attention span and are not necessarily academic. They operate under intense

[8] Starke, F. A. and R. W. Sexty (1992). Contemporary Management in Canada. Scarborough, Ontario: Prentice-Hall Canada Inc.

pressure, serious time constraints and receive advice from various sources, particularly from those who hold financial or political power. Often, it is difficult to objectively decide which policy maker to deal with because the tenure of senior officials for example, permanent secretaries, is such that, within a period of three years there can be four or even more replacements (Kimenyi, 2002). Practitioners such as wildlife managers and policy makers in Government are at time suspicious of researchers and their methodologies (Mugisha , 2003 and DFID workshop, 2004). In the process of being cautious the research recommendations barely influence the targeted policies.

To appeal to policy makers who have the characteristics described above, policy research recommendations need therefore to be relevant, topical, timely and reliable (Kimenyi, 2002). Policy makers have to synthesize and balance the views expressed by different sources of information to articulate policy. Policy researchers are likely to be the least assertive source of information confronting the policy makers, because research reports hardly clamor to be read. In addition, the level of uncertainty inherent in research findings in the social sciences, can dissuade policy makers from embracing them readily. Furthermore, it is often overlooked that money invested in policy research in agriculture or in NRM has opportunity cost in other sectors, such as infrastructure, education or health services. Investment in research has to compete for funding with other uses whose advocates are more assertive than NRM researchers (Nyang'ito, 2003). The observation may suggest that there is need to determine more effective ways of attracting national funds to NRM research and agriculture at large. Farmers associations are potential lobby group and partners in pressing for appropriate policies including those that ensure that research on farming problems is allocated its fair allocation national funds their far

In addition, policy research recommendations have to be "appropriately packaged" for consumption by the policy makers. Researchers are often urged to market their findings to policy makers in research briefs written in a language ease to understand. What is hardly mentioned is that research results have to be articulated in form of implementable action or better still, in form of alternative implementable actions, to appeal to the policy makers. The researcher needs to show the likely costs and benefits of each implementable

alternative (Nyang'ito, 2003). As stated earlier, most research findings go no further than making recommendations deemed necessary to increase agricultural productivity and use of NR in a sustainable manner. A policy maker seeking implementable options compared and contrasted in term of costs and benefits, is actually ahead of the policy researcher in articulating what is needed in generating viable NRM policies and innovations.

2.2 4 Why have past efforts at generating solutions to NRM problems achieved limited success?

The approach to NRM problems about two decades ago leaned heavily on technical solutions with limited success. This prompted inclusion of economic perspective in determining more effective strategies of NRM. Some gains in efficiency were obtained, but it was still evident that other critical components and their interactions had not been identified. Towards the last decade or so, it become increasingly clear that that resource management strategies result from interaction of physical, economic and social components as stated earlier. The social components are widely interpreted to include among others, institutions, governance, power relationships and access to timely and accurate information, not only at the national level, but even more crucially at the local level, where the actual natural resource managers are found. Programs fulfilling these requirements are more likely to yield encouraging results (UNEP, 1995; USAID, 2002; Omamo, 2003).

To effectively combine physical, economic and social components in generating solutions to NRM problems, and to link policy recommendations to plans of action, the focus of researchers has to be appropriate and the right questions have to be asked. Keeley and Scoones (1999) point out that research focus could be policy analysis or the analysis of the process through which policy is generated. The focus on policy analysis per se appears compatible with the view that policy is a simple linear process. Given this perspective, policy is a decision or a statement of the formal position taken by one responsible for a given policy area. That statement is subsequently executed by the bureaucracy. The process is simple and, straight forward. It involves; making decisions, setting the agenda, and implementing them. It appears that the opportunity of learning as the process of

influencing NRM evolves and the technological package and practices are adapted to specific local conditions is lacking or not recognized.

It appears that, the role of the researcher in this approach is to give the policy makers empirical evidence on which to base the formal policy statement or decision. A researcher who declares "here are the empirical results and the recommendations (policy statements) arising from them - I am done; the rest is implementation" most likely identifies with this view of policy. It is a common view held by many researchers. The result is that policy research literature is awash with prescriptions that tell policy makers *why* and *what* to do but hardly *how* to go about it. A plan of action, detailing how to implement the recommendations, including an evaluation of the extent to which the objectives have been achieved is completely lacking. Omamo's (2003) seminal interpretative review of substantive literature, addressing trends, gaps, and challenges in policy research in African Agriculture, cites nine general prescriptions and 20 market reform oriented prescriptions given to policy makers on why and what to do but not *how* to do it. The author is careful to underscore that these are "only a small sample" from major agricultural economics and economic development journals. The author concludes that neglect of the *how* question means that policy researchers are neither posing nor tackling the right policy questions. The report concludes that policy research on African agriculture is *irrelevant* to agriculture because the results generated are inconsistent with what policy makers are looking for. The review underscores that policy makers in the region are struggling with *how* to implement the recommendations stated in research reports. Some examples of recommendations lacking the *how* content found in the current review were:

- avail fertilizer stockists with low interest short term credit (Strasberg et al., 1999),
- encourage mobilization of rural savings and credit institutions in the rural areas as a source of credit for farming activities (Strasberg et al, 1999),
- create an environment conducive to private sector participation (Heisey and Mwangi, 1996),
- enforce standards and quality control in fertilizer marketing (Heisey and Mwangi, 1996),

- train and inform fertilizer traders so that they can advise farmers (Murithi and Shililu, 1993)
- encourage and remove barriers that prevent more participation of private fertilizer importers and distributors (Murithi and Shililu, 1993)

It is not surprising that Omamo (2003) concluded that agricultural economists have failed to address the problems facing policy makers in agriculture because they have not even started asking the right questions. The available literature gives no reason to believe that this conclusion does not apply to NRM problem in the Highlands. It is observed that outcomes of most policies are determined by what happens when implementation starts. This is because the planning process includes evaluating policy alternatives and mapping out responses for post implementation hazards. These are in turn linked to existing governance which defines operational feasibility of the alternative (Omamo, 2003; Keeley and Scoones, 1999).

How then does a policy researcher develop an action plan? Who else is involved? At what point does the role of the researcher come to an end? Analysis of the policy process rather than policy analysis *per se* is a start. It is justified by the observation that policy consists of a set of action or inaction. It comprises interrelated decisions and it evolves over time as it is implemented. Moreover, the policy process is essentially a political process rather than a simple implementation of rational decisions. During implementation the actors can adjust the agenda set, and as well as decisions made, influencing the outcome. Keeley and Scoones (1999) are careful to point out the significant often underestimated influence field-level implementers can have on the policy process. This is because field-level implementers interpret and prioritize instructions facilitate their implementation by removing overlaps, contradictions and improvise where vacuums exists. In the process, they can also block or ignore instructions. Therefore, a policy researcher aiming at developing an action plan, the *how* component of recommendations, will deliberately anticipate and address problems likely to occur during implementation, such as balancing the interests of different stakeholders of the proposed change. These emanate from differences in resource access and availability, social institution, political orientation or even differences in historical background. Therefore another key NRM policy problem

in the Highlands is that researchers have not, by and large, focused on *how* to implement their recommendations and in turn have not benefited from learning as the processes they propose to change evolve.

2.2.5 Inadequate knowledge management in NRM

Knowledge is considered as key in all phases of NRM. Therefore, new methods and tools for knowledge management have potential to increase effectiveness and efficiency in NRM. For example, remote sensing and geographical information systems are powerful decision support tools particularly when integrated with classical techniques such as inventories and ground surveys (USAID, 2002). However, they have not found wide spread use by policy researchers because they not available in many local research institutions such as the universities, owing to lack of funds or the need to re-tool researchers in their use (Obwona and Norman, 2002). A innovative approach is under way to offer Msc and PhD courses in agricultural disciplines through distance learning by tapping the resources of the local universities and the CGIAR centers in the region. (curriculum committee document, 2004). May be this opportunity can be taken to strengthen local capacity in skills and approaches of working with local communities in NRM issues not taught in traditional research methodologies.

There is evidence that data and information already available are not comprehensively used. For example in Kenya, data colleted by the Central Bureau of Statistics was not readily available to researchers in public institutions in the past and a lot of valuable research findings form local organizations are not availed to farmers. Lack of funding for research is difficult to justify against this background. There is also no evidence in the available literature that the many research organizations operating in Kenya for example, with the common focus of reducing poverty through increased agricultural production based on sustainable resource use, are avoiding unnecessary repetition and overlaps. Collaborative research between different organizations particularizes between those with large differences in of funding and pace of executing projects is a major challenge. Perhaps it is a chance to reflect on the difficulties farmers have to over come to create and sustain collective action needed for many NRM technologies and practices. It may also be an

empirical issue likely to benefit from similar experiences from other parts of the world. Failure of researchers to "speak with one voice" to policy makers has been suggested as

This is likely because networks and communities of practice are not common in NRM in the Highlands. These can facilitate sharing experience and empirical data, tapping economies of scale in capacity building and lobbying for appropriate NRM policies and programs. They can also be a potential source of formal and tacit knowledge useful in policy decisions[9]. If policy researchers focus on implementation of initiatives they have to develop monitoring and evaluation systems to provide feedback with adequate data for adaptive management and social learning. Economies of scale are harnessed by sharing data and experiences. The idea is to capitalize on both negative and positive experiences of NRM in the highlands and elsewhere to inform search for sustainable solutions. Usually these experiences and results are unexpected and therefore not captured by traditional evaluation methods[10] but can be shared in networks and communities of practice (USAID, 2000).

2.4.6 HIV/AIDS and related pandemics

Kosero (2003) summarises the critical factors that shape socio-economic developments based on the woodlands as poor soils limiting nutrient a availability, low and erratic rainfall, low value woodland products (constrains woodland conservation), in adequate knowledge of the functioning of the woodlands, increasing human and animal populations, declining agricultural potential, high incidences of HIV/AIDS, malaria and other diseases in the ecoregion and increasing poverty. It is further noted that these factors apply to other natural resources and to agriculture in general. Therefore they have to be dealt with even if the woodlands gave way to crop production as might well happen in the future. This is one of the only two cases found in the literature reviewed where concerns for HIV/AID and related pandemics are linked directly or indirectly to NRM in the region and to the Highlands. The other case is for irrigated rice growing Tebere location, Central Kenya,

[9] Environmental Information Systems –Africa (EIS-Africa is a network of 3,000 environmental practitioners throughout Africa)

[10] Tracker (www.nrmtracker.org) is one of those tools for learning from local resource management initiatives in Africa

where HIV/AIDS is stated along side many water borne and malnutrition diseases common in the area (Egerton, University). The omission is surprising because the issue is consistently highlighted in the media and the attention and some resources of governments in the in the three countries have been directed to this scourge. Each country has a specific program on HIV/AIDS. At household level HIV/AIDS reduces the labour available to earn an income including managing natural resources as a result of sickness, those attending them and shorter life spans. It also draws heavily on the limited financial resources for drugs and other health care. NRM is the most likely area to suffer from the reduced labour and budget, particularly the input without immediate returns.

"The incidence of HIV/AIDS and related pandemics holds potential to drastically alter the demography of the region, reduce agricultural production and increase poverty" p. 6, Kosero, 2003.

It is therefore important that NRM research and policy take full recognition of this factor.

2.3 Political problems as natural resource management problem

2.3.1 Lack of national NRM policy strategy to guide policy research

Lack of a comprehensive national strategic framework to guide NRM policy research is cited as one of the constraints faced by policy researchers in the Highlands. National research priorities are therefore not prioritized and integrated. Therefore funds allocated to policy research are not used efficiently because of overlaps and repetitiveness.

Knowledgeable observers point out that there is a substantive number of worthwhile policies existing on paper and not implemented as well as appropriate regulations which are not enforced. For example, regulations exist prohibiting cultivation of river banks and steep slopes (Yabann[11], 2003; Michieka[12], 2003). If a national NRM strategic framework existed, these regulations and others addressing the same problem might be reviewed to reveal the disincentive leading to non compliance. It is likely that the process would prompt inclusion of stakeholders, especially local level resource managers who would be involved in their implementation and enforcement.

[11] Interview
[12] Interview

The benefits of a national strategic framework in agricultural research are illustrated by Kenya Agricultural Research Institute (KARI). Some progress has been made in integrating agricultural research thorough KARI's long term national research plan, which is made operational by medium term plans of about three years. The programs and projects are selected for funding depending on how well they articulate their potential to contribute to medium term objectives and in turn to long term objectives. Donor funding is accepted only if it fits in with the strategic plan (Murithi, 2003[13]). Proposals from universities and NGOs qualify for competitive bidding for funding under Agricultural Research Fund (ARF) operated by KARI from donor funds (Obwona and Norman, 2001: Murithi, 2003). It was observed that agricultural research and NRM issues in Uganda could benefit from a comprehensively articulated national framework (Tenywa, 2003).

Despite these improvements in research funding through a national organization, it is not clear how additional funds can be raised. For example, it is not clear how research benefiting commodities with marketable outputs such hybrid seed and crop protection be effectively funded by the beneficiaries. What sort of research is best contracted by farmers? Are there precedents to learn from? What areas of NRM research have high public good and externality component and therefore warrant expenditure of public funds? (Raussen et al, 2001).

A problem closely related to lack of national NRM policy framework is lack of consistency among national policies of different sectors (Michieka, 2003; Yaban, 2003; Tenywa, 2003; Heisey and Mwangi, 1996). These policies are often made in isolation even though the anticipated activities overlap, and the common target is poverty and unsustainable use of resources and funding is limited. Consultation with stakeholders such as farmers, farmers groups and associations as well as private sector is not done adequately or it is not done at all. For example, national agricultural strategy is not comprehensive because it does not include a detailed national fertilizer-sector policy and plan (Heisey and Mwangi, 1996). A similar observation is made that the policy of ensuring food security for all in Kenya is not consistent with the policy of leaving privately

[13] Interview

owned, prime agricultural land idle for years in the Highlands, even as landlessness and poverty continue to increase (Yabann, 2003).

Uganda too has pertinent illustrations of conflicting government policies in NRM. For example the government policy is to transfer forest management responsibility to the community but the community prefers to own the forests in their involvement in CFM. Since the poor in the community have no other alternative of generating income other than harvesting forest resources, implementing the policy of regulating yield to sustainable levels is difficult if not outright impossible. Increased agricultural production generally stressed by the liberalization policy prompts clearing of forests for cultivation because inputs such as fertilizer for intensive production on the available land are not available and affordable (Gombya-Ssembajjwe and Banana, 2000).

Similar concerns are raised in view of the national environmental act and policy being developed in Kenya. It is not clear if adequate attention has been given to ensure that it is consistent with the general agricultural policy of reducing poverty and increasing rural incomes by increased use of external inputs such chemical fertilizers, pesticides and herbicides to spur agricultural productivity (Yabann, 2003). Allgood and Kilungo (1996) note that if intensive agricultural production is achieved through heavy use of fertilizer, its effect on the environment will require monitoring. Although in general fertilizer application rates are low, it is not clear if some commercial users in the Highlands are not already using fertilizers in amounts which have negative effects on the environment. In fact, Gachena and Kimaru (2003) suggest that per hectare application of fertilizer in the regions are so low that concerns of overuse and subsequent negative effects on ground water are unfounded. These different views seem to suggest that an underlying empirical question related to sources of external nutrients and sediments in the water bodies in the region, their negative effects and how NRM in the Highlands accelerates the process.

2.3.2 Inadequate funding to agriculture and NRM programs by governments

Public funds allocated to agriculture as a major component in NRM is a telling indicator of the rank given to NRM and agricultural problems by governments relative to other sectors

in the three countries. In Kenya for example, the highest proportion of total public expenditure received by agriculture was 11.2% in 1986/87. The lowest was 4% in 2001/02 (Omiti and Obunde, 2002). Similarly in Uganda agriculture, (research and extension) received only 1.5% of the national budget in 1998/1999. To cover the shortfall, donor funds are used for some of the main programs which impact on agriculture and NRM. Examples are found in agricultural research, market liberalization and reforms and devolution of power to local levels.

Majority of these changes, such as devolving ownership and management of natural resources say forests to the local people (Tanzania), planning and implementing extension programs at location level including hiring the technical expertise needed (Uganda) or implementing catchment approach in soil and water conservation (Kenya), require adequate time for the stakeholders to internalize the proposed change, plan for the long term objective and develop the capacity and institutional framework to handle the change (Omiti and Obunde, 2002; Egulu, and Ebanyat, 2000; Thompson and Pretty, 1996). Since precedence is often lacking to guide these processes, there is need to approach the change cautiously to facilitate learning as the processes evolves. However, this is often not the case. The reform process of liberalizing fertilizer market in Kenya is an example. The process was donor driven and compliance to conditions given by the donor had to be met within a short period of time. The main fertilizer programs of USAID covered about three years. The duration was not long enough for Government to internalize the required changes, think-through the long term implication of the process or learn from it as it gradually evolved. The conditions were set without consulting the recipient. As a result government considered some conditionalities set unnecessary while others were too broad to be implemented and monitored. It is therefore not surprising that at times cosmetic changes were undertaken to appear compliant to the donor. In addition, Kenya as recipient of fertilizer donations had difficulties in mapping an appropriate response when aid philosophies of different donors translate into different conditionalities. In the attempt to be compliant, Government is seen to have sacrificed long term judicious decisions on fertilizer policy (Kimuyu, 1998).

Even though Uganda has substantive experience with local government starting with the resistance councils to address insecurity issues in the early eighties, and community arrangements commonly used for controlling grazing, putting out fires, planting trees and for crop protection measures, the true decentralization process which started around 1989 was seen as a unique opportunity for learning as the process evolved (Raussen, et al. 2001). The Plan for the Modernization of Agriculture (PMA) in Uganda is based on devolution of power, funds and services to the local levels. Donor funding has a specific a time limit to implement the project and show results. This means that people who have in the past simply implemented directives from above are required to hence forth articulate the local needs, decide on the appropriate alternative to address them, plan and implement them and evaluate the success of the initiatives. The communities are required to budget for and hire services like extension which was previously provided by the central government. Clearly all these changes are too overwhelming to be made simultaneously and at short notice. A gradual process appears more rational to allow stakeholders adequate time to learn and make appropriate adjustments so that devolution of power can generate the intended benefits (Egulu, and Ebanyat, 2000). As the process evolves, it will indicate the functions and services which are best left to the central government and those best performed by the local government or the community. Therefore inadequate funding from national governments for NRM policy research and for implementation of programs with long term influence on NRM encourage use of donor funding which demand results within a short period of time. The result is hurried implementation forgoing the opportunity to learn and adjust as the processes evolve.

One of the most common conclusions from analysis of the reforms and liberalization in the three countries is that the process generates gainers and losers and some effects had far reaching negative impacts than anticipated. For example, coffee union in Central Kenya give farmers fertilizer on credit which was used on coffee and food crops through their cooperatives (Strasberg et al.1999; Argwings-Kodhek, 1997). Another main benefit from cooperatives was that members were allowed to borrow lump sum money for school fees and repay from the coffee proceed for the year. Collapse of these cooperative in the wave of liberalization which allowed individual coffee factories to break away form the Union,

meant that farmers had less income from coffee, their output of food crops declined from lack of fertilizer and others were unable to raise school fees for their children. In some case the breakup of the cooperative was very acrimonious leaving a wave of property and coffee bushes destroyed and even actual physical injury.

2.4. 2 Failure to building capacity and invest in human resources for NRM policy research

Although Heisey and Mwangi (1996) pointed out that capacity for policy research is limited in the region as whole, they make it clear that this is not the only limited capacity among those needed to increase agricultural productivity and improve livelihoods in a sustainable manner. They noted that countries such as Kenya need to develop capacity in the public service which can accomplish the following: negotiate with the private sector, forcefully present specific country's perspective to donors and resist donor-pressure in setting policy priorities which are at variance with long term interest of their countries. An obvious strategy suggested was to ensure that public service remuneration is comparable to that of private sector. In addition to remuneration there is need to upgrade equipment and provide stationery, connectivity and other basic service taken for granted in any serious entity focusing on output. Effective collaboration is unlikely if the partners are decades apart in the technologies they use regularly.

In general, brain drain in the three countries is understood as flight of human capital to developed countries. But another brain drain that is less noticeable is one where local institutions such as universities and research organizations loose staff to locally based international organizations. In the past, it was argued that the expertise was still benefiting the country. But it is obvious that, the capacity is no longer available for teaching and training up-coming policy researchers or for long term NRM policy research accredited to the local institutions. Since NRM research requires a number of years to yield results through adaptive change of behaviour and experimentation by resource managers on the ground, local institutions such as local universities and local research centers are seen as better placed to undertake (Tenywa, 2003[14]). An alternative arrangement would be for the

[14] Interview

researchers to be retained at the local institution while engaging in collaborative research with the international organization, possibly with a top-up remuneration (Muriithi, 2003 and Nkonya[15], 2003). But as the number of students admitted to local universities continue to increase against limited numbers of teaching staff (attributed to constraints of government funding to salaries for tertiary education) it is becoming increasing more difficult to combine quality teaching with quality research even in NRM issues.

Capacity to communicate effectively with stakeholders at local level to mobilize community action is also limited. It is not clear how capacity can be build to empower local people to form and run viable farmers groups or associations which can articulate their needs and play leading roles in seeking solutions for them. Mureithi, et al., (2000) reported that Farmers Research Committees (FRC) as part of Farmer Participatory Research (FPR) took a lead role in experimentation in farmers fields, organizing field days and explaining community activity to the visitors. They also solved day to day problems and conflicts arising from on-farm trials. They were also described as being very effective in bridging the gap between researchers and the community. One of the key problems in NRM policy research in the Highlands is that it is not clear how FRC and farmers groups can be made more effective and sustainable.

The available literature on NRM underscores that farmers who generate income from farm production have the incentive and the means to maintain soil fertility, use improved seed and make other investment in farming, underscoring he crucial role of local availability of inputs and access to produce markets. It was assumed that private sector participation in marketing of inputs in the liberalized economy was automatic. It was realized later that the gap let by withdrawal of parastatals in the input and produce market was not adequately fill by the private sector as anticipated. Some of the problems hindering automatic participation of the private sector in the liberalized economy are articulated by the USAID fertilizer program in Kenya as follows: high costs and risks are involved, markets are poorly developed and skills as well as knowledge to develop them are lacking, the benefits likely to accrue from developing the markets are poorly appreciated, and the approach of

[15] Interview

conducting business generally focuses on the short term (Allgood and Kilungu, 1996). These authors point out that in 1996 stockists selling fertilizers in Kenya were about 5,000. Since they are the last point of contact with farmers, they represent a potential not yet tapped to educate farmers on appropriate use of fertilizers. However, the traders were hardly knowledgeable in fertilizer use other than simple identification of "planting fertilizers" and "top dressing fertilizers". In some cases they gave wrong information to farmers. These traders, majority of whom are located in the Highlands, need training to operate in a liberalized economy. Small traders operating in remote farming areas need special attention because they make inputs available to farmers who are even more disadvantaged by market access. The opportunity to use stockists to educate farmers on appropriate and efficient use of these inputs has not been explored. Research is needed to identify the constraint stockists face in their operation, develop their capacity to educated farmers on appropriate use of the farm inputs they stock and determine incentives to do so (Gachene and Kimaru, 2003; Allgood and Kilungu, 1996; Strasberg, et al. 1999)

In NRM policy research capacity can be limiting from the perspective that researchers from biophysical disciplines and social sciences do not normally work together even though the collaboration increases effectiveness of generating practical solutions for NRM problems. For example, the most effective use of natural sciences in solving NRM problems is to delineate biophysical limits and define what is technically possible. The social sciences are more effectively applied in articulating and setting objectives for the community which is a social process (USAID, 2002). The smallholder irrigation project of three communities in Central Kenya, Njoguini, Gitero and Kabati (NGK) reported by Thompson (1991) illustrates how this could be done. The technical irrigation options were explained to the farmers by the technical person from the Ministry of Water Development. But the choice of the option to implement was done by the farmers, representatives together with the technical person, guided by the need for equity and effectiveness given the multiple objectives of the project.

The synergy of biophysical and social sciences is one of the justifications for including social science, anthropology and economics input in on-farm experimentation multi-

disciplinary team. But as noted by Mureithi, et al. (2000), such teams are difficult to work with particularly if the members insist on the perspective of their disciplines without due regard to the contribution of other disciplines. Cohesiveness of these groups may not last the duration of the project and if experimentation and learning is to be encouraged among local farmers, the period can be fairly long, requiring a lot of patience (Mureithi, et al. 2000; Raussen, et al., 2001). It is not clear how strengths of different disciplines can be harnessed to increase the effectiveness of the multidisciplinary groups in solving NRM problems in the Highlands.

Policy researchers are not the only ones likely to benefit from working in groups. The option to finance individual small-scale irrigation for each of the three communities proves prohibitive. The joint venture was affordable and attracted external funding as well technical from the ministry (Thompson, 1991). Examples from other African countries such as Mali, document that organizational development of village association not only gives rural people a forum to negotiate for rights and services with government and outsiders, but it also increases their ability and power to do so. More specifically, the village associations gave the community an opportunity to gain experience and confidence. These skills were used in being proactive, negotiating business transactions and in influencing matters in agriculture and in general welfare to their favour (USAID, 2000).

In the past, building capacity at the local level emphasized commodity related technical skills such as transplanting seedling and grafting. But since economic conditions are changing rapidly, skills that have broad application are likely to more rewarding and relevant over time. Examples are, numeracy, literacy, business development, marketing and, accounting. Theses skills are more effectively imparted through farmers groups. In Mali many of the farmers who received literacy, numeracy and management skills through village associations, started treating farming as a business by investing and diversifying either as individual or in associations. Business skills coupled with legal recognition enabled the village associations to increase loan repayment with commercial banks giving evidence that rural farmers are not inherently poor business partners (USAID 2002). The farmers in the Highlands would benefit from attracting a reputation of loan repayment

from commercial banks and private business community. It is not clear how the skills stated above can be imparted in a cost effective manner to many farmers in the Highlands.

The village associations in Mali are also an example of the additional benefits that can be reaped from organizational development by rural people. Proper management of these locally controlled rural organizations enabled farmers; exploit economies of scale reducing marketing and input costs, negotiate for better prices, and facilitate extension work. The associations were also instrumental in better NRM by encouraging adoption of conservation techniques and dealing with free riders, because they had authority and responsibility of natural resources in their area. In the Highlands of the three countries, there is need to initiate farmers groups and association. Where they exist there is need to review the NRM activities they are involved so that others can learn from their successes and their mistakes. The literature review has not uncovered such study.

2.4.3 What is the role of non-farm income in NRM strategies

Knowledgeable observers consider agriculture as a subset of NRM and caution against the commonly held view that agriculture is central to rural development, it is the major economic engine, the permanent estate and the core of rural activities. They hold the view that agriculture is a dynamic subset of NRM and in some cases it is neither the optimum land use nor the most important. They also caution against taking agriculture as the automatic solution to rural economic growth and poverty alleviation without interpreting it within the context of NRM (USAID, 2002). This rather unique view seems to be supported by evidence from the literature. For example, all the three countries in East Africa since independence in the early 1960s, have depended on agriculture to eradicate poverty with dismal performance. In fact poverty has increased and the agricultural resource base has deteriorated (Egulu, and Ebanyat, 2000; Wanzala et al. 2000; Strasberg et al. 1999 and Karanja, et al., 1998).

On the contrary it could also be argued that the dismal performance of agriculture and rural areas was inevitable considering the urban bias shown by keeping food prices low to benefit the urban consumers and concentrating basic services and infrastructure in urban

areas. In fact the models of development popular in post-independence era in these countries seemed to suggest that the sole role of agriculture was to start-off industrial growth then some how fade-off and leave the lime light to industry, manufacturing and urban livelihoods supported by employment in the modern sector. It has not happened. On the contrary it is now realized after four decades or so that these economies are doomed unless urgent measures are taken to ensure that livelihoods earned from that natural resources in the rural areas are sustainable and well above the basic necessities.

Furthermore, a study which divided Kenya into eight agro-ecological zones where farming is carried out (excluding North Eastern province) showed that 50% of all farming households are involved in off-farm income activities. In fact it is only in three regions, that is, the High Potential, Central Highlands and Western Transitional zones where the proportion of income from crops was higher than that earned from non-farm activities. Even in the four Highlands zones, better endowed with natural resources for agricultural production, 25% to 39%% of the household income was earned from non-farm activities (Table 1). In general 25% of the households in the Highland bought fertilizer from funds

Table 1 A comparison of incomes from non-farm activities, crop and livestock as a percentage of the total household income in different agro-ecological zone of the Highlands in Kenya

	Total household income (Ksh/household)	% of total household income contributed by		
		Crops	Livestock	Non-farm activities
High potential	197,685	47	28	25
Central Highlands	169,166	39	24	37
Western transitional	89,953	41	22	37
Western Highland	60,850	32	29	39

Source: extracted from Argwings-Kodhek et al, 1997, Table 2

earned from off-farm activities and a positive correlation was shown between off-farm income and crop value per unit of land. In a different study, Owour (undated) showed that poor households without off-farm income do not shift to high values crops because they are unable to finance the initial cost of establishing tea, coffee and bananas. They are also not assured of income to purchase food in the transition process. Despite these indicators of the complementary association of agricultural production and off-farm income, it is not clear what other synergies exist between NRM and non-farm activities, the direction of casuality and how they can be strengthened if they exist. It appears the there is urgent need for research to focus on whole farm analyses to determine the role of alternative investment options for the farmer including high value crops, NRM, non-farm activities and their interactions (Place et.al, 2003)

2.4 Community and institutional problems in NRM

2.4.1 How can adoption of NRM strategies be scaled-up and diversity of ecological conditions be accommodated?

The wide range of ecological conditions in the Highlands is too diverse for researchers to cover comprehensively. Therefore there is need for innovative institutional arrangements to encourage partnerships between researchers, local change agents and local resource users. However, it is not clear how the local people can be encouraged to participate in research, experiment on their own or in farmers groups, and to disseminate the results to other farmers. Insightful experience with farmers research committees as part of FPR by Mureithi et al. (2000) was stated earlier. In some of these communities, FRC went on to deal with issues of benefit to the community aside from those for which they were originally mandated. In other communities farmers preferred to do thing individually and FRC did not thrive. The lessons emerging from these experiences suggest further research to explain the difference in performance and sustainability of farmer groups in different communities.

A similar experience of working with farmer groups in solving NRM problem was found in scaling-up agroforesty adoption involving hedgerows planted to control soil erosion in two subcounties of Kabale, Uganda (Raussen et al., 2001). The experience illustrated four

requirements deemed necessary for successful scaling-up of agroforesty adoption. First, the technical innovation must be available in terms of information and germplasm and must be adapted to the local environment. Second, the adoption must be demand driven. Third, it must require low capital and labour inputs. Finally it must provide tangible benefits in a short period.

In the case of Kabale, the adoption was demand driven because the community not only perceived the degradation but actually saw the massive soil and stones carried by water from slopes and deposited on the valley bottom, destroying crops and jeopardizing future cultivation. The people had the incentive to take the measures necessary to halt or even reverse resource degradation because they actually sent village representatives to look for help from research and development agency. The farmers were able to make the necessary investment to halt erosion degradation. The innovation involved growing seedlings to make hedgerows; these could be produced using the same equipment they normally used to grow vegetable seedlings. The number of seedlings each farmer needed was objectively determined by the length of contour hedge adequate for the land. The aim was to keep the requirement of capital and labour low and therefore affordable. The farmers had the choice of growing the seedlings individually or in groups. They could also choose the number of seasons within which to accomplish the task, indicating that the results could be observed with within few seasons. The innovation therefore met the four requirements considered essential for communities to adopt NRM strategies to halt or even reverse resource degradation: they perceived resource degradation; they new where to look for knowledge to address the problem; they had the incentive to halt or even reverse the degradation and they had the means to do so. The desired results were observable with a relatively short period of time (Jones, 2002)

2.4.2 How can the extension service be revamped to be cost effective in dealing with NRM strategies?

In Kenya, the largest section of the Ministry of Agriculture is the Extension service with a budget of about $14,28613 [16]per month per administrative division (Argwings- Kodhek,

[16] Ksh70 = $1

1997b). The Ministry provided little technical input on policy debate on marketing of tea, coffee, sugar and maize arising from competition posed by imports in compliance with World Trade Organization (WTO) regulations, because it does not have capacity for such analyses. The extension service is also said to be over staffed at higher levels, but is short of front line staff who come in contact with farmers.

Funds for field visits and fields days are also lacking and the staff are not available when farmers attempt to visit them at their stations. Argwings-Kodhek therefore concluded that the extension service is a subsidy forced on farmers and the only beneficiaries are the staff drawing a salary. The situation prompts the following questions: How then can farmers have more control over extension funds used in their name? Which investment of these funds is likely to yield higher returns? Should the farmers use the funds to contract extension services as the need arises or should they use them for other pressing needs in the area, such as improving roads, health clinics, schools or access to water? In fact the substantive contribution to high value horticultural crops in the Central Highlands is attributed, at least in part, to closer access to water than found in other area of similar agricultural potential (Allgood and Kilungu, 1996; Owour , undated). In urban areas like Nairobi, associations formed by residents of specific areas have repaired roads and have invoked existing statutes so that the cost incurred is defrayed against the annual land rate payable to the Nairobi City Council. Currently they are demanding to be allocated their share of development funds directly so that they can oversee its use in priorities of their choice[17]. There is no reason why similar trends cannot start in the rural areas. In fact, constituency funds vote by the 8th Parliament of Kenya to be use for priorities specific to each constituency. For the Highland part of the fund could be invested in public good related to NRM such as soil and water conservation on a catchment basis, or strengthening collective action focusing on community nurseries for seedlings.

Farmers' associations were mentioned earlier as institutions that can be used to improve capacity for local people to articulate their priorities, exploit economies of scale in lobbying for their needs, and a forum for learning skills to achieve higher incomes and

[17] Njumbi Road Resident Association Newsletter Issue 15, October, 2003

livelihoods. It is suggested that the private stockists of inputs like fertilizers are potential key private sector partners in technology development and transfer. This is because the stockist has a vested interest in farmers making profit from agriculture. There is very little research input into how to exploit this opportunity. Some NGOs have also been at the forefront in encouraging farmers even in remote location to increase agricultural productivity through sustainable use of resource. In fact in Uganda, resource degradation was found to be less severe in areas where NGOs were previously involved in agriculture in Uganda (Nkonya, 2003). Soil and Water Conservation Branch of the Ministry of Agriculture have made efforts to draw on the skills and resources of NGOs interested in the activities carried out in the catchment approach (Thompson and Pretty, 1996). It appears that the potential for farmers associations, private stockists and NGOs and their synergies to carry out the function hitherto considered the domain of traditional extension has not been sufficiently explored.

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3 SYNTHESIS OF KEY LESSONS AND SECOND GENERATION RESEARCH FROM THE POLICY RESEARCH STUDIES

3.1 Perception of NRM policy research

Despite very frequent reference to "policy research" in NRM literature, it is not quite clear what it entails. A common scenario is a research report that summarizes the findings in form of policy statements presumably to be taken by an implementing agent. It appears that policy researchers view implementation as work outside their scope, because their recommendations do not detail how to effect the changes they deem necessary. The available literature shows that there is no shortage of recommendations in form of why and what factors to manipulate to facilitate sustainable use of NR or say to reform markets. Agricultural policymakers are aware of most of them. However the major problem facing policy makers is how to effect those recommendations, that is, they are looking for the available options, their likely cost and benefits including the problems expected during implementation and suggestions on how to overcome them. The policy researcher is unlikely to have these functional details unless the recommendations are generated from an integrated approach combining natural, economic and governance components and have undergone some piloting case study (Omamo, 2003) or have been developed through FPR (Mureithi, et. al., 2000) or collective action were the farmers themselves own the activity as in catchment approach for soil and water conservation Thomson and Pretty, 1996). This hardly happens.

3.2 Soils

Reduced and declining soil fertility and hence concerns of fertilizer use in the Highlands is one of the main NRM policy problems emphasized in the literature. Low fertilizer use in not only a problem in the East African Highlands but also in most areas of SSA. For example, in 1994, the application rates of fertilizer in SSA were on the average only one fifth of other developing countries not using irrigation. But there is evidence that some countries such as Mauritius and Swaziland, apply fertilizer at the rate of other developing countries (Townsend 1999), suggesting that constraints leading to low fertilizer use in the

region can be surmounted. What lesson can the highlands learn from the experiences of these two countries?

Low consumption of fertilizer in SSA raises concern because it constraints the ability to feed the increasing population and to replenish soils from loss of nutrient from intensive cultivation. In China, Brazil and Indonesia, fertilizer consumption had doubled by 1980s, meaning that these countries experienced the Green Revolution technology. This was based on response of high yielding varieties to reliable water supply and macro-nutrients applied in form of fertilizers. It is suggested that the Green Revolution was not experienced in Africa because of dependence on rainfed agriculture relative to irrigation. It is also noted that the soils in the region are derived from parent material that basically lacks essential micro-nutrients unlike those of many parts of Asia (Townsend, 1999). This observation strongly suggests that the innovation and technologies of the Green Revolution were not fully compatible with local condition in SSA region because constraints and incentives for their adoption were not identified. Therefore, the challenge for sustainable NRM strategies in the region is to adapt the components of Green Revolution and test innovations in the local situations, guided by the constraints which will determine their success or failure.

3.3 Integrated soil fertility management

In Central Kenya multiple source of nutrients are used because fertilizer and manure are available. Hardly any use of organics and fertilizer is recorded in Uganda possibly because fertilizers are not available or they demand is poor. Development of markets for organics is constrained by their seasonal availability their bulkiness (low nutrient value per unit mass). It is not clear how these constraints can be minimized. Further research is need in the following area:

- All agronomic research on ISFM has been on cereal crops but most smallholders direct their ISFM inputs to the under research high value crops.
- Land and labour are the inputs need to produce organics on the farm. These are existing constraints particularly in the Highlands, meaning that enough quantities

for individual farms are not produced and hardly any is available for sale. More research is needed to identify ways in which farmers overcome labour and land constraints in use of organics.

- Research on economic analyses of farm-managed ISFM is needed to determine its attractiveness and returns relative to fertilizers.
- How will organics and ISFM be implemented as farm sizes continue to shrink.
- How does profitability of ISFM compare among high value crops for different market conditions
- What is the role of inorganic nutrients in stimulating improved seed use.
- What is the direction of causality between use of organics and production of high value crops.
- What synergies, exist among, incomes crop-mix, institutional and physical infrastructure, land tenure, alternative on-farm investments, farmers knowledge and market opportunities to draw investment into farming through increased use of improved seed and fertilizers?

For wider adoption of ISFM practices the following are needed:

- Develop more attractive options for ISFM practices into strategies of smallholders-improving germplasm is one of the key ways.
- Since ISFM are knowledge intensive, innovative ways have to be determined for scaling-up information and knowledge provision as well as technical support.

More effort needs to be directed to identify commercialization options for farmers. Low commercialization correlates with both poverty and absence of sustainable agricultural intensification through investment in land. It is also not clear how social economic characteristics of smallholders are linked to use of soil fertility management practices to inform initiatives for minimizing constraints in their wide spread use.

3.4 Land degradation and NRM strategies

In an attempt to understand on-farm environmental degradation and constraints to the adoption of soil conservation and the interaction of people with technology and how those

interactions become potential causes of degradation using evidence from a study of farmers in Uluguru, Tanzania, Jones (2002), raised other questions meriting further research:

- What is the relative priority farmers give to productivity maintenance over other activities that absorb labour and possibly capital? This part of the incentive for preventing land degradation and embarking on soil conservation.
- What are the incentive and disincentives to remedy land degradation?
- How and where do cultural institutions serve the same purpose as land titles and privatization in giving security of tenure?
- How do social and cultural factors cause environmental degradation? In the past, economic determinants, considered too simplistic and deterministic by some observers, were used to explain farmers behaviour in adoption of soil conservation technology to the exclusion of detailed examination of social and cultural factors
- What measure of improving soil fertility can be developed that do not increase financial burden to farmer or consume more land or labour in areas where poverty is a significant constraint like in Uluguru?
- Is green manure one of the options for fertility management by resource poor farmers? What indigenous shrubs are used for green manure in other areas in the Highlands?
- In what circumstances does earning of off-farm income become instrumental in reducing /increasing investment in agricultural productivity or reducing or increasing soil degradation or other components of environmental degradation?

3.5 Fertilizer, subsides and reforms

High fertilizer prices were taken as the main reason leading to low fertilizer use in SSA in general and in areas with superior natural endowment as the Highland of the three countries. Governments of Kenya and Tanzania therefore attempted to increase fertilizer use through fertilizer subsidies justified with the following arguments. Subsidies would: compensate farmers for low output prices as a result of taxation and price support to farmers in the west; reduce farmers' credit constraint and risk aversion in using fertilizers

who prices are high due to poor roads; facilitate adoption of agricultural innovation in the early uptake phase; contribute to reducing soil fertility since traditional methods of maintaining soil fertility such as fallow period were untenable under population pressure.

But other reviewers opposed fertilizer subsidies pointing out that; large rather than small scale farmers benefited most, public funds sunk in subsidies are better utilized in improving infrastructure, or facilitating in other ways an efficient private sector that could import and markets fertilizer. Alternatives use suggested for the funds was improving research and extension to make crop technologies responsive to fertilizers and widely known by farmers. They could also be used to refine fertilizer recommendations (Townsend 1999).

None-the-less, beginning from the 1970s to early 1980s, all most all countries in SSA had implemented fertilizer subsides either implicitly by overvaluation of the currency, or by explicit subsidies of varying proportions. For example, Tanzania had a 60% subsidy on fertilizers. The subsidies resulted in limited choice of basic fertilizers, distorted prices as well as unreliable marketing and distribution systems operating at high cost by paratastals. Even though the fertilizer subsidies were a burden to the government budgets, the average fertilizer use per hectare was still very low compared to other developing countries with rainfed agriculture. The lesson learnt was that investing public funds in fertilizer subsidies alone was not the most efficient way of increasing agricultural productivity and in turn reducing poverty.

The early 1980s saw the advent of structural adjustments programs; fertilizer sector reform was one of them. In the initial period, reforms focused on removal of fertilizer subsides which had reduced the price of fertilizer below border parity levels. Public marketing monopolies were retained because it was envisaged that more efficient and competitive marketing would be achieve through cheaper bulk purchases, importation and distribution of fertilizers. In addition, public monopolies did the procurement while wholesaling and retailing were liberalized.

Since attaining food security and raising incomes are key objectives in the three countries, there was need to determine the effect of market reforms on fertilizer use and in turn on food crop productivity. It was found that removal of subsidies and devaluation of local currencies resulted in significant increases in the price of fertilizer. It had been thought that higher fertilizer prices would be offset by higher export crop prices (more volume exported with devaluation). This did not happen because 25% of SSA fertilizer consumption had gone to maize production while export crops such as coffee and tea, common crops in the Highlands, account for less than 1%. Therefore the grain farmers carried the full burden of higher fertilizer prices without any benefit from higher export crop prices (exporting more commodities). The subsequent increase in fertilizer cost reduced fertilizer use particularly by smallholders (Place et. al 2003; Gachena and Kimaru, 2003). This appear to confirmed past experience which showed that some vertical integration as found in parastatals which distributed inputs, marketed output and performed credit functions served farmers better because they lowered costs of inputs and improved loan repayments. The emerging lesson was that removal of parastatals which used to supply credit and distribute fertilizers, reduced farmers access to fertilizer input. However, no empirical evidence was found in the literature to show how much of the decrease in fertilizer use can be attributed to each of the two factors that is, removal of subsidies and market liberalization acting on prices

3.6 Fertilizer costs

Lessons emerging from a study by Wanzala et al. (2000) on possible ways of reducing fertilizer marketing costs in Kenya stress the following:

- Despite the liberalization of the fertilizer market, there are relatively few players especially importers and wholesalers. In 1999 for example, one wholesaler supplied 83% of retailers in Kitale. Marketing costs account for a substantial percent of the farm gate price of fertilizer in Kenya. In 1999, transaction costs and marketing cost accounted for 57% of the farm gate price of Diamonium phosphate (DAP). This could be broken down into; importers margin, wholesalers margin,

transport costs, retailers' margin and port charges that accounted for 16%, 15%, 18%, 3% and 5% respectively.

- Poor roads especially in the rural areas significantly increase the transport cost of fertilizer. In Kenya farm gate fertilizer prices are higher than in neighbouring Ethiopia even though the distance from port to the main distribution center is about twice as long. For example the distance from Mombasa to Eldoret and Kitale is 867 and 788km respectively. In 1997 and 1998 the price range for DAP in these towns was $420-470 per ton. In contrast, major production areas in Ethiopia are 600-700 km from Addis-Ababa which itself is 900 km from Assab the main port but fertilizer prices in these areas were about $350 per ton. In Kenya where roads are too poor for *matatu* (common mode of transportation), farmers ferry fertilizer on *boda-boda* (bicycle) but the charge for 20 km distance is about one half the cost of transporting the fertilizer from Mombasa to Kitale, a distance of 877 kilometers (Wanzala, et al. 2002)
- Although rail transport is much cheaper compared to road transport, most importers do not use it for three main reasons: shortage of wagons, delay in delivery of fertilizers to the point of sale, and absence of compensation for transit losses. This is a specific area needing public sector facilitation.
- Relative to retailers, importers and wholesalers have capital and networks to overcome transaction costs to acquire good market information. Retailers also lack the capacity to ascertain the wholesaler behavior. Since the importers need the wholesalers to provide the distribution network, and the wholesalers need importers to extend credit in form of fertilizer paid for at a later date, a kind of reciprocity is created excluding the retailers who have no access to information and credit. The retailers appear to be the disadvantaged group in this market yet they are the direct link to farmers who also need credit and information.

Evidence from three districts in Kenya (Trans-Nzoia, Kisii and Kakamega) showed that a wide range of factors varying with location explain difference in fertilizer at district level (Argwings-Kodhek, 1997a). Therefore fertilizer recommendation from extension which

have not been revised to reflect the changing economic conditions such as fertilizer and output prices or changing soil fertility, are at variance with adaptive practice of farmers. It is therefore not surprising that farmers ignore these recommendations. In Trans Nzoia for example, Diammonium phospate (DAP) fertilizers had been used over many years such that the soils have adequate amounts of phosphates but they still need nitrogen fertilizers. Yet, until the mid 1990s two bags of DAP per acre of maize was the standard recommendation from extension. Widespread promotion of fertilizer use without soil testing is a waste of scarce resources. But the traditional procedure for soil testing at about $ 86[18] per test is too expensive for the majority of the smallholders and takes too long. Since there are wide variations in soil fertility and circumstances of individual farmers, innovative initiatives are needed to make comprehensive soil testing accessible and affordable by farmers' own initiatives.

Two such initiatives are noteworthy. On Farm Productivity Improvement Project (OFPIP) in Siaya, Kenya was undertaken by Catholic Relief (CARE), International Center for Research on Agroforesty (ICRAF) and a local NGO. It combined soil testing to guide selective minimal fertilizer recommendations with carefully selected local maize varieties which out yielded the hybrids because they withstood intermittent rainfall better. In the same area, Siaya Community-Oriented Development Programme (SCODP) found that phosphate deficiency and acidic soils are the main soil factors limiting maize and sorghum production. They developed materials enough for plot trials, packaged in mini packs of 100 and 500gms complete with instructions. The packs are sold in local shops, schools, churches and markets. The objective is to facilitate the farmers to experiment and identify the appropriate fertilizer regime unique to their land and to buy fertilizer in affordable amounts (Argwings-Kodhek, 1997a; Omamo, 2002).

3.7 Food crop productivity

Since maize is one of the leading stable foods in the rural and urban in the three countries, it low output per hectare is a major food security and farm income concern. Karanja, et

[18] Ksh 6,000; Ksh70 =$1

al., (1998) found that adoption of hybrid maize in Kenya was positively influenced by favourable maize prices, higher education particularly secondary education, value of farm assets, and extension contact. It was negatively influenced by the distance from motorable road, but farm size in acres and intensity of fertilizer use had no effect. They also found that intensity of fertilizer use was positively influenced by use of hybrid seed, proximity to fertilizer market, level of education, extension contact and price of maize, while farm size has no effect. One Kenya shilling invested in fertilizer raised maize productivity by Ksh5.86. The same study showed that maize productivity was influenced positively by proximity to motorable roads, extension contact, education level and presence of male head in the household. After controlling for other factors, extension contact had a positive impact on both hybrid seed and fertilizer use and hence productivity. On the average, maize market reforms led to a decrease in maize productivity in almost all ecological zones averaging 10% in the highlands, but much lower in the lowlands where less fertilizer was used. This was because the effect of lower maize price was mainly transmitted through less use of fertilizer (Karanja, et al., 1998).

Strasberg et al. (1999) evaluated the effect of education on fertilizer application and productivity of food crops per acre. Education was defined as two dummy variables that is, at least one member of the household had completed primary school, and at least one member had pursued post secondary education. Both were found to have positive and significant effect on the two variables. The lesson emerging from these studies is that road infrastructure and formal education have significant effect on agricultural productivity and in turn NRM, even though they are not normally the concern of ministries of agriculture in the region. The observation supports the need of integrating the priorities of ministries that seek to influence rural communities. In addition, local people organized in farmer associations can take charge of local infrastructure such as feeder roads.

3.8 Commercialization and food productivity

Synergies likely to exist between food crop and non-food cash crop production have been ignored by research and extension assuming implicitly or explicitly that non-food cash

crops are detrimental to household food security (Govereh, et al, 1999). Strasberg et al. (1999) concluded that in Kenya, the effects of particular cash crop on food crop productivity and fertilizer use showed wide regional variation irrespective of the household-level of commercialization. The study concluded that the effect of commercialization on food crops productivity cannot be generalized because the effect varied depending on the type of commercialization, how the dealings are organized and how they facilitate smallholder access to inputs, management advice, market outlets and minimize risk inherent in market prices.

The study concluded that the degree of commercialization varies widely a cross agro-regional zones in Kenya. Even within zones, there are significant differences in the degree of commercialization. The effect of size of land owned in acres did not have significant on crop commercialization index. The study concluded that, holding other factors constant, in general household agricultural commercialization had positive and significant effect on food crop fertilizer use and productivity. The same conclusion was made by Govereh, et al, (1999) noting that striking positive synergies on food crop productivity and smallholder incomes were found where there was successful cash cropping arrangements. Specific examples are coffee in Murang'a Coffee Union and sugar cane in Mumias Outgrowers Company in Bungoma and Kakamega in Kenya which increased access of inputs on food crops. These examples further indicate that liberalization involving private marketing and processing firms need not have negative effects on food crop production incentive and intensification. Moreover food security is also income where trade exists.

3.9 Lessons from small-scale irrigation system.

Even though irrigation is one input which can increase productivity, successful small-scale irrigation systems are rare in the Highlands. The case study of the small-scale, gravity-fed, farmer managed irrigation system linking three communities in Nyeri District Central Kenya gives some insights into some critical resources and services that farmers require. It also underscores the local and external components that influenced farmers' decisions and action regarding the design, implementation, operation, and maintenance of the

irrigation systems illustrating how success can be achieved. Thompson, (1991) concluded that this irrigation project succeeded where many had failed because:

- Technical options of irrigation were explained to farmers and technical people from the Ministry of Water Development office together with farmers' representatives selected the most equitable and effective for their multiple needs.
- All stages of the irrigation system design construction and management used local knowledge, insights and experiences of the farmers.
- The design of the project did not follow the standard design which views projects as technical/engineering challenges. This created an opportunity to consult farmers.
- To solve the problem of free rider, late payment for project membership and subscription fee attracted a penalty of Ksh50 per day up to a maximum of Ksh600. New families wishing to join the water association had to pay Ksh 6,350 for membership and labour contribution.
- The irrigation project executive committee of three NGK communities turned their attention to other felt needs for example, access roads, milk processing facilities, food storage and electrification. This is an example of inter-relatedness of felt needs and priorities in the rural areas. Failure to address such issues by researchers engaged in on-farm research with participating farmers is probably a component of what was referred elsewhere as "raising farmers' expectations" (Mureithi, 2000). This observation gives credence to the concerns that rural space is controlled by too many ministries resulting in inadequate coordination of effort and synergy
- The NGK executive committee advises neighbouring communities on local water-user group. This an example of farmers learning from farmers and gives an opportunity to see a proven innovation, first hand.

Other factors which affected the genesis and sustainability of NGK small-scale irrigation system with possible application in NRM are:

- Change of system (rain fed to irrigation), choice of crops and choice of technology (irrigation) was made to happen by real need prompted by very low productivity, crop failure, famine, drought and long distances to fetch water and *NOT* by government policy. This is an outstanding lesson of the possible outcome generated by pressure on resources, perceived needs and opportunity. The project was implemented using the policies that exist, at least on paper, and completely lacking evidence of their existence on the ground. The observation supports the view that the way forward for NRM problems is to identify local opportunities which can be exploited to respond to felt needs without necessarily waiting for government policy. The success achieved can then be used for policy advocacy.
- NGK farmers had control of their resource - they had title deeds to land and access to reliable adequate water supply. Hence incentive existed to make long term investment in resource management as shown by growing of perennial crops crop rotation, crop diversification and use of animal and crop residues to improve/maintain soil fertility.
- NGK farmers had a local institution (water-user association) with organizational capacity for management and day to day services (control of water level and maintaining of each field channel) and conflict resolution needed in a small-scale irrigation system. By themselves bureaucratic agencies cannot provide these components. Water-users associations were formed to for perform three things:
    - Design, construct, operate and maintain the irrigation system with technical support particularly in the initial phase (irrigation system development).
    - Manage water (water acquisition, allocation, distribution and drainage).
    - Organize (make decisions, mobilize resources, facilitate communication and resolve and conflicts).
- Other factors contributing to the success of NGK water institution was the mode of operation of its executive committee. It promoted democratic decision making, maintained sound financial management, encouraged and attracted active participation from the members, possessed irrigation and organizational knowledge and received local and external recognition of its achievements.

3.10 Technology transfer and scaling-up

Some of the problems of extension service organized in a top-down manner are shortage of front line staff, outdated recommendations, low morale, and substantive allocation of public funds spend on staff salaries for services farmers do not receive. Farmers associations, private sector stockists and NGOs are suggested as potential partners in technology development and transfer.

Scaling-up proven innovation is a major NRM strategy challenge. The approach used in Kabale, Uganda to scale-up hedgerow planting to control erosion was unique and insightful in the NRM adoption process for two main reasons. First, it allowed the innovation available normally to be modified to meet local needs. Second, it allowed the role of researcher to shift from merely generating innovation to concentrating on issues crucial in the implementation stage which hardly feature in research papers and reports that is:

- introducing farmers to innovations by arranging trips to research stations and to other areas where they could see for themselves what was possible and to choose what they considered best for their own situation.
- encouraging identification of more than one best-bet innovation for farmers to experiment with on their own to boost enthusiasm.
- giving advice to farmers on how best to set up tests to determine the best adaptation.
- monitoring the widespread testing by farmers because trial and error experimentation involving thousand of farmers meant that only the fittest innovation survived and could be a basis for subsequent innovation.
- facilitating more than just the agroforesty adoption in the community by being involved in related activities. For example the Agroforestry Research and Development Project offered to support typesetting and printing of the sub-county quarterly bulletin (Raussen et al., 2001).

3.11 Assessment of performance of NRM strategies

The success or failure of revised NRM strategies, institutional change and policies need to be assessed periodically and there is need to better understand the subsistence farmers by linking rural livelihoods to natural resource use and management. To do so effectively a set of local indicators will need to be developed. The sustainable livelihood method was applied by Bahiigwa et al. (2000) in six study sites in two districts in Uganda to assess the impact of policies and institutional change on the farming system and asset status framework. Asset status can be used to measure access to utilization and endowment status of capital. The capital measured in a particular farming system can be natural, physical, financial, human or social. The success of refocused NRM strategies would be evident over time in change in capital status of communities managing resources.

Another alternative approach for planning natural resource management involving extensive areas is the "catchment approach" using Participatory Rural Appraisal (PRA). It consists of concentrating resources and efforts to conserve all farms with a specific catchment area (200-500 hectares) for a limited period of time. Thereafter the community and local extension agents are left to carry out small adjustments and maintenance work (Thompson and Pretty, 1996). In 1988, Soil and Water Conservation Branch (SWCB) of the Ministry of Agriculture introduced this approach and has been found effective in linking groups and institutions in particular catchment committees, technical assistants, women groups, local leaders, NGOS and government departments such as water development, health and public works. An additional benefit of the approach is to increase the commitment of farmers to implement and manage the innovation.

Although more significant economic, environmental and social benefits are achieve from catchment or watershed management activities planned using catchment approach and Participatory Rural Appraisal (PRA) relative to methods such as Train and Visit (T&V) approach, Thompson and Pretty (1996) observed that adoption of soil and water conservation practices in Kenya are slow for the following four reasons: (1) technology packages are inadequate (2) participatory implementation inconsistent (3) farmers are not

receiving adequate information (4) ownership rights to land customary or legal do not exist for some areas. (5) It is also likely that the effect of negative experiences from the colonial period when all indigenous soil conservation measures were sidelined and foreign ones imposed by bureaucratic measures ignoring farmers needs have not been forgotten. Indigenous soil conservation measures are likely to have been loss from lack of opportunity to pass them to the younger generation. These factors constrain the effectiveness of PRA

4 PRIORITIZATION OF KEY GAPS FOR FURTHER POLICY ESEARCH

4.1 Revised approach to NRM policy and policy research

The ultimate test of effectiveness NRM policy and policy research is the extent to which they can be attributed with appropriate resource management on the ground. Therefore one of the first priorities for NRM policy research is to articulate approaches combining natural, economic and governance components in generating effective strategies for NRM problems at local resource user/ manager level. The integration of these components underscores the resource manager on the ground and policy makers as the key consumers of NRM research output.

The available literature indicates that policy makers in agriculture are stranded because the researchers do not provide implementable options presumably because the likely benefits and cost of different option are not specified. There is a suggestion that as pilot trials or case studies of options can provide the needed information more systematic implementation of work should be undertaken. The resource user/manager at the local level would be a key participant in the pilot trials. Researchers and farmers would have an opportunity to learn as the process evolves. Benefits of the innovation would be apparent to the collaborating farmers and they would adopt them without waiting for policy change or further extension contact. Other farmers are likely to notice these changes and take an interest if they are significant enough from their own evaluation. In this manner, change will have been introduced not from policy but from exposing an innovation to a community with a need for it. These experiences would be the basis for subsequent policy advocacy. But in practice, policy change may take a long time to occur because the different vested interests have to be addressed. It therefore seems practical for researchers to ensure that their recommendations are taken up by the targeted farmers who then can add their weight in advocating for enabling policy. For example, in the process of determining if milk hawking in Kenya's liberalized dairy industry is a health hazard to consumers, the team of the Small Dairy Project by ILRI and Ministry of Agriculture trained hawkers and

smallscale milk handlers on low cost hygienic methods of handling milk and testing it at source to minimize spoilage.

4.2 Soil fertility and crop productivity

Gaps for further research on soil fertility and crop productivity include:

- If the region as a whole did not benefit from the Green Revolution as other regions did, then those innovations and technologies were not fully compatible with local conditions and constraints. The incentives for their adoption were not fully identified. Therefore, the challenge for sustainable NRM strategies in the region is to develop and test the innovations in the local situations, guided by the constraints determining their success or failure as stated above. If soils in the region are unique because they are derived from parent material that basically lacks essential micro-nutrients, then they can not be expected to respond to inputs in the same way as those of other regions, nullifying the basis for comparison. However, the factors which have enabled countries in the region such Mauritius and Swaziland to apply fertilizer at the rate of other developing countries (Townsend 1999), while most other countries apply far much less, need to be identified for possible adaptation to local conditions in the East African Highlands. Maybe in the case of Mauritius the dominance of sugar production explains the high fertilizer use.
- In Kenya, considerable intra-zonal variation in agricultural land productivity exists. For example in the Central Highlands and the High-Potential Zones the range was 4300 to 31400 and 8000 to 26500 Ksh/acre respectively. Research is needed to determine the special constraints faced by farmers whose productivity falls below the mean in each zone with a view to facilitating them to pull up production up to at the mean level. The unique characteristics of farmers attaining productivity well above the mean are also not known.
- Institutional changes in the way the maize sector is organized affect input use and productivity through non-price factors. The mechanisms through which they operate are not yet identified (Karanja et al., 1998).

- The general tendency is for farmers to plant non-hybrids when they lack access to fertilizers (Karanja et al., 1998) indicating a needed to revisit the issue of hybrid maize seed for the resource constrained farmer. For example, is the hybrid maize seed therefore the seed farmers should be encouraged to plant even without fertilizer? Can the hybrids be adapted to tolerate moisture stress? Has there been an over emphasis on hybrid seed removing attention from the potential of carefully selected local varieties for farmers who can hardly afford fertilizers?
- Removal of parastatals which used to supply credit and distribute fertilizers, reduced farmers' access to fertilizer input. The subsequent increase in fertilizer cost had significant effect on farm income and fertilizer use. This confirmed past experience which showed that some vertical integration in input distribution, output marketing and credit functions serves farmers better because it lowers costs and improves loan repayments. What institutions can be financed by farmers to play the same role more effectively? How can the public sector facilitate such institutions? Is contract farming one of the alternatives? What are the major constraints faced by smallholders under different contract farming arrangements?
- Packing regulation for fertilizer needs revision to allow smaller packages that are more easily affordable by farmers. Truth-in-labeling needs to be enforced to control fraud and prevent sale of substances that are harmful to the soil or inferior quality seed. For this to be effective, rules of sampling have to established and ranges set to show the acceptable range of variation of composition for various nutrients (Townsend, 1999). How can these services be provided in a cost effective manner?
- For the private sector to invest in the opportunities availed by removal of parastatals in agricultural commodity and input markets, it has to be guaranteed to be supported by stable policies conducive to profitable business. Often this is not the case. For example in Kenya, the government has been on-and-off maize liberalization policy increasing private skepticism over the political will to make genuine changes. How can the public sector be induced to provide the conditions needed for the private sector to efficiently provide the services?

- Studies are needed to better understand the conditions that have led to successful reform of agricultural markets and to identify strategies to move the reform process further. Such a study was done by IFPRI for five African countries none of which were Kenya, Uganda or Tanzania.
- The factors that make importers and wholesalers margins significantly higher than those of retailers are not understood. It is not clear whether the margins are genuine or possibly arising from collusive behavior (Wanzala et al., 2000).
- Although price is one of the key determinants of fertilizer use and the effect of some non-price factors such as proximity to the markets implicitly impact on demand, there is scanty evidence on estimated fertilizer demand elasticities for the various zones. These would enable prediction of fertilizer response to potential price changes, and could be used to lobby for policies having direct effect on lowering prices.
- Why are there few players in the fertilizer market even after liberalization particularly in Tanzania and Uganda? Access to credit is an obvious limitation. However, research suggests that there must be more disincentives beyond credit (Wanzala et al. 2000).
- The available evidence shows that fertilizer retailers are unable to access credit. Therefore, they buy fertilizers in small consignments and restock when sold out, increasing transaction costs, and causing intermittent shortages during the crucial time of fertilizer application. How does this limitation of retailers affect the marketing costs and in turn efficient use of fertilizers by farmers (Wanzala et al. 2000)?

4.3 Liberalization and private sector participation in agriculture

Agricultural policies implemented in Kenya since independence - before reforms and with reforms 1980 – 1995 can be reviewed with a view to identifying policy research gaps and policy weaknesses over the years. One of those reviews (Nyangito, 1998) concluded that a comprehensive analysis of the impact of the reformed policies on agricultural productivity and growth has not been done, and their impact on different stakeholders has not been

evaluated. More specifically, the following gaps in knowledge were highlighted as meriting further research to guide policy in the liberalized economy:

- How can government facilitate marketing and processing of agricultural commodities previously under parastatals but currently managed by the private sector or farmers' organizations?
- In delivery of agricultural services such as research, extension, animal health and machinery, what is the policy defining the role of government versus the private sector?
- Which policies are needed to guide institutional reforms to be in tandem with the reforms in the agricultural industry and other complementary sectors?
- What are the policies guiding infrastructure development as a basic requirement for increased productivity and efficiency in agriculture?
- What are the policies that ensure that macro–environment is conducive to increased agricultural productivity?
- What are the policies guiding land use and utilization?

It is suggested that *"policies have been a cause of the problems in the agricultural sector and the reduced contribution of this sector to the development of the country* (Nyangi'to, 1998 *p. 10)"* because agriculture has been plagued by inadequate implementation of policies particularly from the mid-1970s. Overambitious policies not matched to adequate resources for proper implementation, mis-timing and poor sequencing of policies, including poor internalization of policies before implementation owing to donor pressure, are some of the factors thought to explain lack of policy implementation.

The basis on which agricultural policy is made is deemed questionable because data on the agricultural sector is weak, and often reported in a way which does not inform and shed light on key policy debates or challenge long-standing perceptions (Argwing-Kodhek et al., 1997). Since agricultural policy has not kept pace with factors which make the sector and the entire economy dynamic, such as structural adjustments, market liberalization and rapidly changing technology, it is to a large extent out-dated. Therefore, one of the challenges of NRM policy research is to keep a data base that is regularly updated.

4.4 Synergies derived from production of commercial crops

As stated earlier, successful cash crop commercial production has positive synergies with food crop production (Govereh et al., 1999; Strasberg, 1999). But to develop more informed policies to support smallholder welfare in the current situation of widespread market inefficiencies, there is need to understand more clearly the ways in which crop commercialization can affect food productivity, incomes and food security (Govereh et al., 1999). Argwing-Kodhek et al., (1997) note that farm size seems to influence commercialization and diversification into high value crops. Empirical evidence showed that a significant proportion of households with relatively small farms in fertile areas, had a higher percentage of marketed crop production out of total production, particularly high value crops (horticulture, tea and coffee). Consequently the livelihoods and saving of surpluses by these households is vulnerable to market forces.

Empirical research is needed to determine how specific successful commercialization initiatives of marketing and processing are linked to smallholders, and how the component that explains their success can be duplicated and expanded to cover other areas. It is also not clear how commercialization influences other components of NRM such as erecting soil conservation structures, growing trees for wood fuel, dependency on non-farm income, and conflict or synergy between livestock and crop production. Since liberalization policy has been influencing economic activity for the last ten years or so, there is need for more specific research to further inform and update the following concerns on commercialization:

- What are the pathways in which the private sector can configure its operations in the post-liberalized environment to promote smallholder agricultural productivity? The challenge is for researchers is to identify the pathways, and for government policy to facilitate them in creating positive interactions between food and cash crops, and between the public and the private sector.
- Empirical results have shown that high credit repayment is characteristic of viable cash cropping arrangements. What public investment is needed to strengthen the incentives for loan repayment by eradication the perception farmers have that credit

programs are gifts and will with time be forgiven? Such an investment can be justified as a public good because it has benefits accruing beyond the immediate beneficiaries.

- Lending money by the private sector is contingent on an appropriate legal framework to protect lenders. Reviews of the existing legal framework need to be revised in light of the unique conditions in each of the three countries. Similarly, modalities of handling credit repayments in drought and conditions beyond the control of farmers need to be worked out. Researchers would make their contribution by the determining how loan repayment can be increased in view of the constraints facing farmers.
- Finally, it is likely the synergies such as those described exist between high valued cash cropping and management of natural resources at farm and regional level. These need to be identified and facilitated.

4.5 The role of livestock in NRM in the Highlands.

The increase in population growth outpacing the increase in food production is linked with hunger, poverty and environmental degradation. But often not mentioned is that increasing livestock pressure has led to overgrazing in forests, woodlands and grasslands. Increasing human and livestock population pressure "*continues to drain soil nutrients from forest soils, exacerbate soil erosion, accelerated water run-off, and increase siltation of rivers and dams among other effects. p.2* Kosero, 2003*).* In Kenya the smallholder dairy industry especially in the Highland cannot be ignored in concerns of poverty, sustainable livelihoods and NRM. ILRI (undated[19]) underscores that:

"*It is difficult for a person raised in a materially rich country to appreciate the kinds of assets accumulated by people in poor countries living on the margin of the economic respectability. In severely cash-scarce environments, livestock –generated micro-enterprises and micro-assets allow people to plan for the future and see families and communities through hard times, when prolonged drought or rain or market fluctuations take their toll. Importantly, such livestock enterprises also act as 'starter' that enables*

[19] ILRI (undated). Accumulating Assets through Animal agriculture, ILRI, Nairobi , Kenya.

people to raise themselves and their families from degrading poverty to low income to middle income……. In addition, cattle, sheep and goats are the nutrient (manure production) and financial (dairy income) crankhandles of smallholder systems, acting as catalysts that jack up the viability and health of those systems as a whole……. With the hope that an animal generates in the milk, power, manure and income it provides, people pursue new goals and, by achieving them, enhance the quality of their lives".

4.6 Constraints of the reformed dairy industry in Kenya.

Livestock income contribution to household income was found not to be the dominant source of income even in the Highlands. However, Argwing-Kodhek, et al., (1997) concluded that there is wide potential for increasing the contribution of livestock enterprise to household income because it is only in the Central highlands of Kenya that sale of livestock products are about 75% of the value of livestock assets. Elsewhere livestock enterprises are hardly commercial, being characterized by low input-low output typical of traditional store of value source of psychic income. There is an obvious need for public and private investment in pasture management, disease control and improvement in genetic potential of animals, to ease resource constraints preventing off-take of livestock enterprises. However, it is not clear how such services can be organized and provided in a sustainable manner.

Omiti and Muma (2000) are more specific in the gaps in knowledge that research can address to facilitate policy and institutional strategies to commercialize the dairy sector in Kenya:

- How can farmers be facilitated to form farmer organizations or groups to lower the cost for breeding services such as artificial insemination? The service has completely collapsed after the withdrawal of government subsidy.
- What regulatory mechanism can be put in place to maintain the quality of semen and monitor various breeding organizations to ensure efficiency and sustainability?

- How can the government become more effective in monitoring the standard of feed quality and enforce fair trading practices? This mirrors the need for quality control in farm inputs such as fertilizer mentioned earlier.
- How can research increase production and use of fodder, farm by- products and reduce reliance on concentrates over wide areas? Some gains have already made in agroforestry and the challenge is to scale-up adoption.
- What role can the government play to ensure that disease and tick control under privatization is profitable to ensure sustainability? In the 1970s, disease free zones were established to encourage beef production for export. What components of livestock disease control have public good attributes and therefore are most efficiently managed by the public sector?
- Does security of land tenure determine efficient and sustainability of dairy production?
- What is the role of livestock in general and smallholder dairy in particular, in sustainable NRM in the Highlands?
- What is the revised role of Farmers Training Centers in the reformed dairy sector? Could they be used to train private stockists as partners in technology transfer and farmers in developing viable groups and associations?
- How can different donors of dairy research programmes be coordinated to exploit synergies and avoid duplication? Similar concerns are raised for NRM research.
- How can higher returns be realized from dairy research and demonstrated to convince the government to invest more in research? How can dairy farmers' cooperatives be used to lobby for policies facilitating smallholder dairy production? What is an effective way of dealing with seasonal surplus milk production?
- Have the policy reforms in the industry such as liberalization of retailing of fresh unprocessed milk been backed by an appropriate legal framework?

4.7 Small-scale irrigation as part of NRM strategy

The gaps in knowledge revealed by successful small-scale irrigation projects related to NRM strategies can be summarized as:

- Problems such as running smallholder irrigation and community prevention of soil erosion are people centred. Therefore, the technocratic style used in the past needs replacing with one where setting objectives and potential solutions to problems is primarily done from a social perspective, with the biophysical technical sciences defining the limits and possibilities (Thompson, 1991; Rausen, et al. 2001).
- How can local knowledge be encouraged and used more effectively in design, construction, operation and monitoring of initiatives such as smallholder irrigation systems and other NRM strategies? Knowledge gained during initial stages is used in further planning. The opportunity of learning and adjusting as the projects make progress in phases can be more effectively utilized.
- How can farmers' local knowledge and skills to develop smallscale systems such as irrigation be used without creating non sustainable dependence on external assistance (Thompson, 1991)?
- The way forward for irrigation–based farming systems is to learn from the past successes and failures. However little information is available particularly on crop water requirements and agronomic/ agricultural engineering issues.
- A clear national irrigation policy on the role of smallholder irrigation projects is lacking. There is no well defined plan of action. Different but related functions and responsibilities fall under different public service units increasing inefficiency and bureaucracy.
- Since several organizations are involved with irrigation at district level, poor coordination and lengthy administrative procedures result in financial unaccountability, disorganized planning and long delays.
- The engineering component in irrigation marginalizes social science concerns such that the programs suffer from lack of effective communication with farmers, particularly women, and in turn inadequate identification of local needs and priorities. They also fail to start new local institutions or to strengthen old ones that can mange and maintain the irrigation systems. This begs for a return to the

integrated approach underscored earlier for all NRM strategies. The recurring concern that farmers do not own the processes which affect their lives and have no control over funds spent on their behalf is also found in management of irrigation systems.

4.8 Land degradation and NRM strategies

The need to link sustainable NRM to social economic characteristics of farmers as underscored by Jones (2002) prompts these questions meriting further research:

- What is the relative priority farmers give to productivity maintenance over other activities that absorb labour and possibly capital?
- What are the incentives and disincentives to remedy land degradation?
- How and where do cultural institutions serve the same purpose as land titles and privatization in giving security of tenure?
- How do social and cultural factors cause environmental degradation? In the past, economic determinants, considered too simplistic and deterministic by some observers, were used to explain farmers' behaviour in adoption of soil conservation technology to the exclusion of detailed examination of social and cultural factors
- What ways of improving soil fertility can be developed that does not increase financial burden to farmer or consume more land or labour in areas where poverty is a significant constraint like in Uluguru,?
- In what circumstances does earning of off-farm income become instrumental in reducing /increasing investment in agricultural productivity or reducing / increasing soil degradation or other components of environmental degradation?

4.9 Land tenure and NRM strategies

In the analyses of land tenure it is often assumed that trees are like buildings and are owned by whoever owns the land. Apparently there are examples in Africa where this is not the case suggesting that 'tree tenure' must be distinguished from the tenure of land on which trees are grown. It is not clear if situations exist in the Highlands, meriting this

separation. However, four classes of rights holder must be considered separately: state, groups, households, and individuals within a household. Gender may be an additional complicating factor. In societies where women cannot own land, their rights to the trees may be restricted. Where planting of trees establishes rights to land, women may be forbidden to plant trees to prevent them from using this route to obtain land (Dorner and Thiesenhusen, 1992). Again it is not clear if this is the case in thee Highlands.

In different analyses, Place and Hazell (1993) found that in general in rainfed agriculture land rights were not significant in determining whether or not farmers made land improving investment, used land enhancing inputs or in used formal credit. Land rights were also not related to yield. Therefore, the factors that explain differences in yield, credit use, and land improvements among farmers with the same land rights are not clear. Research is also needed to determine the factors more constraining to the development of efficient and financially viable credit institutions than land titling.

4.10 Management of forest and tree resources

The link between sustainable use of forest resources and improved rural welfare, particularly that of the poor, is complicated further by the need to develop a firm basis for separating causes from correlates of deforestation or other unsustainable use of natural resource. The resulting policy has to treat causes rather than symptoms. For example, Deacon, (1994) using data from 129 countries, including Kenya, Uganda and Tanzania, found consistent association between deforestation and political variables reflecting insecure ownership such as political unrest and instability. The study was prompted by the view that many of the factors thought to cause deforestation are endogenously determined and are therefore correlates rather than causes of deforestation. It is commonly held that population pressure directly causes deforestation. What is least acknowledged is that population pressure often leads to patterns of distribution of land and other resources which threatens means of livelihood, breeding political unrest and instability and in turn accelerates deforestation. Kosero (2003) underscores that political and social instability exacerbate desperate competition for resources. It is not clear how the contribution of

community based management of natural resources to governance can be increased as an input in wider political and social stability in the Highlands and the region at large.

Planning of forest and tree resources is hampered by limited understanding of the links between sustainable use of natural forest resources and poverty reduction by development professionals and policy makers (Kosero, 2003). It is also not clear how national policies or lack of them, affect forest resources through strategies to achieve the desired forest conditions and to increase the contribution of forest to livelihoods and economic development in sustainable manner. It is also not clear how the village, as the legal entity vested with CBFM in Tanzania, can be emulated in the different administrative structures of the other two countries.

Population pressure is one of the factors which drive the state to declare ownership of forests previously managed by local communities as common property with a view to protecting and conserving them. Often this fails to happen and the resource becomes open access because the local community no longer has incentive or the power to manage it as common property (Dorner and Thiesenhusen, 1992). In Uganda, empirical evidence suggests that absentee *mailo* and public tenure systems are inefficient in managing land and tree resources, but there is need to do further investigation based on micro data before making clear-cut policy recommendations (Place and Otsuka, 1998).

It appears there is need to determine the extent to which the current policies on forests in the Highlands adequately guide use of natural resources in light of population pressure and exploitation which is not for subsistence purposes alone (Bohero and Vedeld, 1999). There are other tenure related concerns lacking empirical information for example:

- To what extent do tenure arrangements of natural resources such as forests serve as incentives for sustainable management?
- Local communities can be given the mandate to manage forests in public land that fall within their village boundaries. Are such arrangements involving common property management sustainable?

- Clearly defined rights, clear rules, systems for sanctions, conflict resolution mechanisms and collective choice are the basis for the institutional arrangement in the management of common property resources. These have been shown to hold in successful cases of common property forest management. It is not clear what other NRM can be studied under the same framework to identify constraints to sustainable use and management by local communities in the Highlands.
- How can local communities managing common property be facilitated to enforce control on land use?
- How do households with different social-economic characteristics within a village impact differently on forest degradation?
- What indicators give a firm basis for separating causes from correlates of deforestation or other unsustainable use of natural resource so that the resulting policy treats the causes rather than the symptoms (Deacon, 1992)?
- What evidence is available in the Highlands that population growth need neither positively correlate with degradation nor be the cause of degradation? Tiffen and Gichuki (1994) give evidence from Machakos District, a marginal area, that that recovery from soil degradation can happen over time even as the population is increasing, given the correct technology, incentives and institutional support.

4.11 Local participation and governance

That sustainable NRM strategies require local participation is a recurring theme in the available literature. But how to ensure local participation is not documented. Identification of stakeholders can be difficult because there are different groups such as traders, small farmers, large farmers and landless, people who have differences in resource endowment and priorities (Place, 1995), including politicians with vested interests. It therefore not clear who speaks for "stakeholders". Therefore there is need to identify cost effective ways of identifying stakeholders and to determine:

- The incentive structure to reward grass root workers with essential skills needed to facilitate local communities to identify, rank, and prioritize their needs. How can

they be facilitated so seek assistance outside the community? What incentives are given to workers with social concerns (Thompson, 1991)?

- The uses to be made of local participation. Local communities have the advantage of understanding locally-based resource issues and in identifying appropriate implementable strategies. But they do not have the advantage in identifying optimal solutions because they lack awareness of innovative initiatives and ideas developed elsewhere (Place, 1995). How can researchers facilitate this process? The experience of farmers planting hedgerows to control erosion in Kabale, Uganda described earlier, illustrates how some researchers facilitated this process (Raussen and Musiime, 2001).
- How can local communities be empowered to acquire the ability to make known their opinions and to negotiate for their interest? How can they ensure that their opinions are respected and their decisions enforced by higher authorities (Place, 1995)?
- How can understanding of ecosystem management be increased and broadened so that communities are more aware of external effects of management of head waters, migratory species, removal of forest cover and soil erosion that have wider jurisdiction (Place, 1995)? But the question of whether the focus of research should be NRM or livelihoods also need to be addressed (Sseerunkuma, 2003)[20].

4.12 Scaling-up innovation

How can the beneficial effects of agro-forestry development demonstrated in Kabale, Uganda and else where be scaled-up? The approach advocated by Raussen et al. (2001) involves enabling farmers to analyze and plan a range of options and solutions. The most important requirement in this approach is that the farmers themselves identify the options and the solutions and that the institutions involved should be available to maintain regular and open dialogue with the farmers**.** The authors are at pains to point out that the approach requires patience to allow "initiatives to grow and farmers to plan and explore for themselves". More social science is needed to give insights on how to make this approach

[20] Interview

more effective. Research is also needed to compare the external inputs needed in this approach to those needed for the traditional technology-transfer approach where the researcher develops technologies and the extension agent takes them to the farmers.

Despite the above stated positive experiences with demand driven agro-foresty adoption in Kabale Uganda, it is not clear how local governments with similar problems or programs can establish networks to share resources and information on NRM issues. Such a network would be an example of communities of practice stated earlier and advocated as a potential tool in improving information and knowledge management. The networks would facilitate sharing of experiences, capitalizing on empirical data and exploiting economies of scale in capacity building and lobbying. It would also be a tool to facilitate drawing out and sharing informal knowledge and to assist local institutions on how to approach NRM problems. The community in Kabale had a local bulletin which the research and development agent agreed to assist in type setting. This was an opportunity to avail in the local language and in a user friendly manner, facts, relationships and local institutions of similar experiences else where in the world, to enhance the understanding of ecosystem functions and management concerns in the area, targeting the actual people with greater responsibility over natural resources management. In other countries, drama and puppet shows have also been used to drive home NRM messages (Raussen et al., 2000; USAID, 2002; Place, 1995).

4.13 Investment in NRM policy research

The agricultural sector has been receiving a declining proportion of total national budgets in Africa over the years. Even at research institution level the scarce research funds are not allocated based on empirically determined potential returns. Omamo et al. (1999) illustrate a methodology that could provide national policy makers with basis for comparing investment in agriculture with those in other sectors. The methodology can also be used to compare investment in agricultural research to other investments in the same sector, and potential returns to research in various concerns of NRM.

Methodologies need to be developed and refined to convince the national policy makers that the past trends of investing in agriculture with only immediate concerns of increasing incomes, economic growth and equity, while ignoring sustainable use of agricultural resources such as suggested by soil fertility management research is one of the major factors explaining decreasing income and degraded resources bemoaned in the rural sector.

As policies and programmes focus on inducing desirable change in NRM, there is need to have effective methodologies and clear indicators for assessing the change achieved. Lack of adequate methodology, including verifiable and measurable indicators of success and sustainability of farming systems, makes it difficult to identify and compare the impact of different policies or lack of them on these systems. Bahiigwa, *et al.,* (2000) demonstrated a methodology based on sustainable rural livelihood approach. It is also not clear what other methodologies are available and how the results they generate compare in accuracy to those based on livelihood approach.

4.14 Capacity in NRM policy research

Obwona and Norman (2002) found that in general training for agricultural economists in Eastern and Southern Africa is weak in subject matter areas that are needed to appreciate the processes of liberalization, commercialization of agriculture, decentralized decision making, empowering local people and communities, sustainable production and accountable governance right to the local level. These concerns are not covered in subjects of mainstream economics but they are of practical significant to research and development related employment such as participatory/system/sustainable livelihood approaches, natural resource economics as well as adoption and impact assessment. It is not clear how upcoming policy researchers can gain this knowledge and skills and how practicing researchers can be re-tooled (Bagoola,[21] 2003).

In addition, researchers need to determine cost effective ways of communicating with policy makers and other stakeholders. The methods of making the general public aware of

[21] Interview

existing polices and the implied entitlement are not yet identified. Such awareness is what urban residential associations have used to ensure that the tax they pay and public funds allocated are actually used to improve services in their areas.

It is also not clear how competent public service employees can be given incentives in form of pay, equipment and operational funds to engage in policy research which involves stakeholders including the private sector, or how professional researchers can be encouraged to overcome the constraints of working in multidisciplinary teams with as many stakeholders as possible in developing and transferring technology. It is also not clear how the positive benefits of NRM initiatives can be demonstrated to policy makers to prod them to formulate policies and enforceable laws of natural resource management and use by involving the stakeholders (Mowo, et al., 2002).

Some observers consider political science as very a important input in NRM strategies but it hardly features in the training of policy researchers or in influencing their deliberation in policy. For example, Omamo (2003) argues that agricultural policy research even on liberalization concerns, normally excludes a political perspective even though the structure of interest in agricultural market develop from the interaction between inherent competition and distribution of political power. That is, given a different political power distribution, the same competition of markets would be expressed differently. The author cites two examples to illustrate the significant influence of political consideration on policy. In Kenya, it is argued that the import tariff on maize is not removed because cheap imports will out-compete the local producers. This view often carries the day even though maize is the staple food for the poor in urban and rural areas and lower maize prices would avail a cheaper source of food. Empirical evidence shows that 60% of maize producers are net buyers of maize and would prefer a lower price. Omamo (2003) concludes that analysis of maize policy in Kenya is “meaningless” unless it takes into account the political power exerted by large-scale maize producers located well away from main consumption areas. There is no evidence that it is driven by the objective of availing a cheap staple food to the poor. Similarly in Uganda Omamo (2003) argues, any analysis of

PMA which does not take into account the political implications from the stakeholders such as donor pressure, will not fully appreciate the challenge of implementing this reform. It is not clear how these real and significant influences in NRM can be adequately accommodated in policy research.

Appendix 1 "Ujamaa" in Tanzania

The legacy of "ujamaa" policy is the main institution which continues to impact on natural resource management that distinguishes Tanzania from the other two countries. It genesis and impact is summarized by Kihiyo, and Kajembe (2002) as follows: *Ujamaa (*popularized to mean African socialism an economic and political philosophy seen to uphold extended family, welfare concerns for the whole community and cooperation) as it was practiced in Tanzania under the leadership of Nyerere since 1968 had the following features**:**

- The state controlled the major means of production and exchange with a view to removing social classes which facilitate exploitation of man by man, reduce income gap between rich and poor and between the rural and urban areas
- The objective was to achieve economic development using own funds and resources and accept aid, loans and grants only if they did not interfere with the political integrity of the country.
- The emphasis was on rural development which entailed villigization, living in *ujamaa* in planned villages
- The objective of the villages was to harness traditional values of co-operation, gradual use of modern technology so that the income of the rural masses could be improved by transforming low technology smallholder farming.
- *Ujamaa* is supposed to have been inspired at least in part, by Marxism but it lacked a major element of such ideology in that it was not a consequence of class struggle or a result of revolutionary change. The old mode of production and relationship of a developing economy which the rest of the developed world remained intact. It is only the state which related differently with the entities it had created.
- *Ujamaa* villages as autonomous entities governed by those who lived in them using own bylaws were scheduled to began their existence in 1967 and were supposed to operate on the basis of production by cooperative and communal property holdings. The main role of the government was to educate the masses on the advantage of living in *ujamaa* .

- However establishment of *Ujamaa* village on voluntary bases failed for various reasons: (1) The marginalized population in cash crop and areas and those living where land was scarce anticipated that the villages were an opportunity to make them better-off economically. Their expectations were not met and they left the villages. (2) Production from the initiated cooperatives did not live up to people's expectations prompting people to leave the villages (3) In relatively less endowed and established areas, *Ujamaa* villages were seen as an opportunity to enjoy free socio-services from the government. The bulk of the population was in this category. The collapse of the village was inevitable because the services could not be provided adequately for all who expected them.

Consequently living in *Ujamaa* in rural areas was enforced and the following can be noted:

- The villagization policy shared some characteristics with those launched by the colonial government in the 1950s, continued by independent government and then abolished.
- The location of villages was determined by the location of existing facilities (schools dispensaries, roads and water) with little regard to availability of large tracts of fertile cultivable land.
- Hostility, resentment and despair were inevitable in areas where actual physical coercion was used to move people to villages. The process resulted in destruction of property, related hardships and acrimony.
- In some cases the new locations for villages were selected with a view to punishing those with the best buildings in the old villages. These houses would be demolished.
- Many villages were unplanned with very little space between houses. Privacy was an issue and tree cover was minimal.
- Land for fallowing was no longer tenable because it had to be cultivated intensively. The areas surrounding the villages were the source of fuelwood. Severe environmental degradation and deforestation became the legacy of the areas around the villages.

The village government:

- Chairperson and a village council (village government) of 25 members were elected to run the affairs of the village assembly made up of all adults of the village (above 18 years).
- The council was divided into 5 committee – (1) defense and security, (2) production and marketing, (3) planning and finance, (4) building and transportation, and (5) finally education, culture and community development. Each was run by 5 members.
- The village sub-committee is under production and marketing committee.

ANNEX 2

ANNOTATED REFERENCES AND BIBLIOGRAPY

Alden -Wily, L. A, Akida, O. Haule, H, Haulle, A. Hozza, C. Kavishe, S. Luono, P. Mamkwe, E. Massawe, S. Mawe, D. Ringo, M. Makiya, M. Minja and A. Rwiza (2000). Community management of forests in Tanzania: A status report at the beginning of the 21st century. *Forest, Trees and People Newsletter* No. 42

This a record of developments that have occurred in Tanzania since 1994 to a clear picture of community based forest management (CBFM) and to spelt out the way forward. The paper describes what it considers as the basis of the recovery of the woodland which has hitherto been degraded under regulation of use by government forest guard. In the late 1994 eight villages officially took over the management of a woodland, 9,000 hectares, which the Government had previously demarcated intending to declare it the Huru-Haitemba Forest Reserve. Among the 14 authors, 13 have been directly involved in launching CBFM and one of them has acted as a facilitator.

Allgood, J. H. and Kilungo, J. (1996). An appraisal of the fertiliser market in Kenya and recommendations for improving fertiliser use practices by smallholder farmers. Field report, USAID, Kenya.

The report is based on reviews of secondary data, reports related to USA/Kenya fertilizer marketing program, and interviews with institutions, firms involved in the fertilizer sector and farmers in key agricultural areas in, September/October 1996. It gives the back ground to agriculture in Kenya, a review of fertilizer situation in Kenya and USAID fertilizer programs in the country. It concludes by giving the opportunities to achieve improved efficiency and performance in the fertilizer subsector with focus on improved use by smallholders.

Argwings-Kodhek, G. (1997a). Factors constraining fertiliser use in Kenya. An interim report on ongoing work. Tegemeo Institute/Egerton University, Kenya.

The report in based was part of an on going study focusing on the reasons why farmers use no fertilizer at all and those who use apply quantities well below the recommended rates. The report concludes by citing some innovative initiatives that have combined site specific soil testing and fertilizer recommendation identification involving the farmer, while ensuring that the fertilizer is available in affordable packs widely distributed by a network readily available in rural remote areas.

Argwings-Kodhek, G. (1997b). Contemporary issues determining the future of Kenya agriculture: An agenda for policy research. Tegemeo Institute of Agricultural Policy and Development/Egerton University, Kenya Agricultural Research Institute, and Michigan State University.

The paper reviews the current status of agricultural sector in Kenya with a focus on market liberalization to assemble the available information giving context to emerging broad theme and lessons with a view to making a contribution to mapping the way forward. It does so by focusing on crops which have to compete with imports, that is, dairy and beef, maize, wheat, coffee and sugar as well as credit, research and extension, policy formulation and guidance as inputs in the process.

Argwing-Kodhek, G., T.S. Jayne, G. Nyambane, T. Awour and T. Yamano (1997). How can micro-level household information make a difference for agricultural policy making. Tegemeo Institute of Agricultural Policy and Development/Egerton University, Kenya Agricultural Research Institute, and Michigan state University.

Descriptive analysis of regional baseline data (1996/1997 season) on a set of indicators of the state of agriculture and rural welfare to provide policy relevant data as part of baseline information which can used to measure progress toward the goals of income growth, commercialization and intensification, food security and equity. The sample 1,540 households from 9 agro-regional zones (combing agro-ecological zone, administrative and political boundaries) covering the entire rural Kenya was selected base on proportional depending on population. The agricultural sector data are weak often reported in a way which does not inform, shed light on key policy debates or challenge long-standing

perceptions. Sine it has not kept pace with factors which make the sector and the entire economy dynamic such as structural adjustment, market liberalization and rapidly changing technology it is to a large extent out dated and of limited help in policy formulation.

Arnold, J.E.M. (1998). Managing forests as common property. FAO Forestry Paper 136. Rome: FAO

The study reviews the literature to assemble available information about the role of common property as a system of governance. Systems with historical and indigenous origins in Asia Sub-Saharan Africa and South America and drawing are examined to derive lessons from the decline in management of forests as common property and common property regimes that have endured or emerged. Case studies include from various regions and countries illustrate contemporary management program, that is management of natural resource on communal lands (Mexico and Zimbabwe); joint of collective management if state forest (Nepal and India); management of forestry and agriculture on forest land (Philippines and Thailand); and management of collective forestation on village lands (India and Korea). The experiences drawn from past and continuing experiences are assessed concluding with implications for policy, research and practice.

Arnold M. and Dewees P (1998). Rethinking Approaches To Tree Management By Farmers. Natural Resources Perspectives. ODI

The paper emphasizes the need to change policies and practices that presently constrain farmers' access to markets and those that depress market prices for their tree products. There is need to phase out state production of forest products for which the farm level production has a comparative advantage.

Bahiigwa, G.; Shinyekwa, I.; Nabbumba, R. and **Kempaka, G. (2000). Indicators of success/failure and sustainability of selected farming systems in Uganda. Sustainability indicators for natural resource management and policy working no. 6.**

To fight poverty, there is need to better understand the subsistence farmers. To this end the research applied the sustainable rural livelihood concept of development (which attempts to link rural livelihoods to natural resource use and management) to develop a set of local indicators of success/failure and sustainability that can be monitored over time with a view to assessing the impact of policies and institutional change on the farming system using six study sites in two districts in Uganda. It presents basis for site selection, participatory methodologies used to understand farming systems of study sites, asset status framework (used to measure access to utilization and endowment status of natural, physical, financial, human and social capital) for a particular farming system .

Beintema, N. M., F.M. Murithi, and P. Mwangi (2003). Kenya ASTI Agricultural Science and Technology Indicators. ASTI Country Brief No. 8. IFPRI, ISNAR AND KARI.

The report focuses on the institutional developments and trends in investments in public and private agricultural research in Kenya using empirical findings from 26 agencies. It briefly describes institutional development in the late 1990s, human and financial resources in public agricultural research and development in the period 1971-2000, and source of KARI funding in 1994-2000 as the main agricultural research agency in Kenya.

Bohero, A. A.,and P. Vedeld (2000. Building of local forest management institutions: Observations from selected villages in East Usambara mountains in Tanzania. In: Temu *et al.* (eds.) *Off-forest tree resources of Africa.* Workshop proceedings held at Arusha, 12th–16th July 1999. AAS, Nairobi, Kenya, pp 171–186

The paper focuses on the East Usambara Mountains in Tanga region - north-eastern coast of Tanzania. The field survey covering four villages consisted of meetings, interviews with village key respondents, talking to individual farmers and field observations. The study sought to determine the extent to which eight Ostrom's principles thought to be the key characteristics of communities that have owned and used resources sustainably over long period of time are evident in the manner the villages manage the public forests under their jurisdiction.

Brandão, A.S.P. and G. Feder. (1995). "Regulatory policies and reform: the case of land Markets" In C. Frischtak ed.. ***In Regulatory Policies and Reform: A comparative perspective,*** **Chapter 10 pp191-209 Washington D.C: World Bank.**

The objective of the paper is to present a robust framework showing how land markets function, the major policy and regulatory constraints to their efficient operations and the implication for reforms. It starts by detailing the characteristics of the land market. It then considers policies that have direct or primary focus on the operation of land markets, that is, policies imposing direct constraints on the exercise of property rights (tenure insecurity, zoning and other restrictions and prohibition of land transactions) and those that operate through prices to affect exercise of property rights (speculation, rent controls, and taxation of rural and urban land)**.** Policies with indirect effect on land markets are considered and two phases are suggested to effect regulatory reform in land markets. The first face involves dismantling existing distortionary policies followed by a second phase of legal and institutional reforms. The paper concluded with suggestions for further research

Deacon, R.T. (1994). Deforestation and the rule of law in a cross-section of countries. ***Land Economics 70 (4): 414-30***

The paper is s prompted by acknowledging that caused of deforestation are not well understood. It examines effects of security of property rights on deforestation by defining property rights indirectly, that is, in terms of measures of political turmoil and representation. It tests hypotheses on the association of deforestation rates and three variables, that is, population growth, income growth and political attributes. Data of 129 countries (Kenya, Uganda and Tanzania among them) given in 'An Interim Report on State of Forest Resources in Developing Countries' (1988) by FAO was used. The method of analysis included descriptive statistics and regression analysis. Although the main focus was the effect of insecure ownership on deforestation, indicators of political and legal stability that underpin security of ownership are striking. They include frequencies of political assassination, riots, major constitutional changes, guerrilla warfare, attempts at

revolution, riots and government regime change. Measures of political representation included type of government executive (military, elected or monarch) frequency of political purges and existence of an elected legislature.

Dewees, P. A. (1995). Wood product markets as incentives for farmer tree growing. In: Dewees, P. A. and Arnold, J. E. M. (eds.) ***Tree management in farmer strategies: Responses to agricultural intensification*****. Oxford University Press, Oxford, UK. pp 198–241.**

The paper traces the development of Black Wattle Woodlots in Kenya since introduction during the colonial times. After its introduction, there was a surge in the area under wattle which decreased later on especially after independence. Wattle is good for charcoal production with high conversion efficiencies. The paper questions the government's policy of subsidizing paraffin in order to reduce charcoal consumption.

Dorner, P. and Thiesenhusen, W. C. (1992). Land tenure and deforestation: Interactions and environmental implications. UNRISD Discussion Paper 34, Geneva, Switzerland.

The paper focuses on how tenure regimes interact with population and behavioural variables and how the interaction of the two influence deforestation.

Egerton University (2001). A participatory analysis of poverty in Tebere Location, Mwea Division, Kirinyaga District. Policy analysis for participatory poverty alleviation (PAPPA), Tegemeo Institute and PRA Programme

The objective of the study was to identify viable and sustainable ways to alleviate poverty among rural communities. Tebere location was selected because it had both underdevelopment and widespread poverty (including the usual characteristics in addition to scarcity of potable water, high incidence of water borne diseases, malnutrition and HIV/AIDS infections). It also had unexploited opportunities for sustainable development (such as irrigated rice, French beans and tomatoes in addition to maize and beans

production). Participatory rural appraisal and policy analysis matrix were the main methods of analysis used.

Egulu, B. and Ebanyat, P. (2000). Policy processes in Uganda and their impact on soil fertility. Managing Africa's soils No. 16, IIED and IDS, UK.

The study was carried out in the districts Pallisa and Kabarole in eastern and western Uganda respectively as part of Nutrient Networks and Stake holders Perceptions project (NUTNET) with a view to find out how stakeholders perceive soil fertility and policies of decentralization, PAM and revival of by-laws relating to soil and water conservation as some of the policies with an impact on agriculture. In particular the focus was the extent to which these policies were formulated and implemented in a participatory manner and whether or not the local councils are adequately empowered to implement decentralised policies particularly Plan for Modernization of Agriculture (PMA). It also sought to determine how decentralization affects agriculture and in particular soil fertility management (SFM) and to come up with suggestions for the way forward. The participatory and interactive approach to obtain information from a wide range of stakeholders including farmers, administrators, councillors, NGOs, extension workers researchers policy makers and opinion leaders.

El-Ashry, M. T. (1992). Natural resource management and agricultural productivity in Sub-Saharan Africa.IFAD Staff Working Paper 2. International Fund for Agricultural Development.

This is the second paper in the series "Natural Resource Management and Agricultural Productivity in Sub-Saharan Africa" aimed at generating discussion on the role of alleviating poverty to achieve sustainable development. The paper give an over view of negative indicator of development across the region. The bulk of the paper highlights the relationship between natural resources, environmental conditions and the general policies explaining the present state of low agricultural productivity and environment degradation. It concludes by underscoring why the past and existing policies have gone wrong noting that there is a wide range of technical solutions for increasing agricultural productivity in

Africa. International donors and national governments need to realize that resource productivity problems in the region are a result of inappropriate policies and weak institutions.

Gichuki F.N. (1992). Utilization and Conservation of Wetlands: an agricultural drainage perspective in Crafter *et al Wetlands of Kenya*. Proceedings of the KWWG Seminar on Wetlands of Kenya, National Museums of Kenya, Nairobi, Kenya, 3-5 July 1991. IUCN.

The paper focuses on the utilization and conservation of marshy and swampy lands of Kenya. Reclamation of wetlands for crop production yields a mixture of desirable and undesirable effects. In the reclamation efforts the complex inter-relationship between people, land, water resources, environment and development must be considered.

Gombya-Ssembajjwe and A.Y. Banana (2000) Collaborative forest management in Uganda: The case of Butto-buvuma forest reserve (p 25-33). In *Community-based forest resources management in East Africa,* eds W.S. Gombya-Ssembajjwe and A.Y. Banana Uganda Forestry Resources and Institutions Centre (UFRIC).

The paper reports on the project initiated by the Makerere University Department of Forestry and Forestry Department of the Ministry of Lands, Water and environment in 1994/95 as a pilot case study. The overall objective of community based forestry (CFM) in Butto-buvuma was to manage the forest resources sustainably through the following specific objectives: 1. To improve the condition of the forest (50% of it had been degraded illegal activities of over-harvesting for timber, charcoal, commercial firewood and cultivation of commercial vegetables and sugarcane) and 2. To regulate utilization activities and to enable the forest to contribute directly to the income generation for the community.

Gordon, A. (2000). *Improving smallholder access to purchased inputs in sub-Saharan Africa.* Policy series 7, Catham, UK: Natural Resources Institute.

The paper assesses several initiatives in Uganda, Malawi and Zimbabwe to improve access to inputs. The paper recommends that packaging some of the purchased inputs in smaller quantities can increase their use by farmers. The paper also underscores the role of informal lending in improving access to credit.

Gordon, H. (1994). The impact of structural adjustment on agricultural services: Uganda case study. Final version report to FAO, Nairobi, Kenya.

The paper argues that structural adjustment programs have suppressed input demand due to higher prices. The various players in the market i.e. farmers, buyer and input suppliers have poor access to credit. The paper advances that there has been poor sequencing of crop and input liberalization.

Govereh,J., T.S.Jayne and J. Njoro (1999). ***Smallholder Commercialization, Interlinked Markets and Food Crop Productivity: Cross-Country Evidence in Eastern and Southern Africa.*** **Michigan State University, Department of Agricultural Economics and the Department of Economics.**

Household-level survey data from Kenya, Mozambique and Zimbabwe was used to determine whether smallholder cash crop commercialization can appreciably stimulate food crop input use, and productivity, to understand the pathways for this stimulus and to determine how cash crop schemes can be designed to maximize such synergies. In Kenya Phase 1 of the study involved 1,540 households in 24 districts in May 1997 (Tegemeo Institue/ Egerton University survey). In Phase 2, two areas with positive cash crop/food crop synergies and two areas with tradeoffs were selected and a broad range of stake holders depending on the crop chosen were interviewed. For Kenya, econometric models were used to estimate determinants of fertilizer used on crops and crop productivity identifying the effects of commercialization at both household and crop specific levels. To measure the potential of regional spill-over effects for the Kenyan sample, effects of other household and location specific factors were controlled for, while measuring how the intensity of cash cropping activity and the institutional arrangements in a particular region affected food crop fertilizer use and productivity.

Gowing, J., N. Hatibu, G. Wyseure and D. Young ( ) Local solutions to irrigation needs in semi- arid Africa

The paper describes work undertaken by University of Newcastle upon Tyne in collaboration with Sokoine University in Tanzania to evaluate and promote rainwater harvesting in semi-arid areas of Africa. The study is motivated by the observation that irrigation systems are widely observed to perform below their potential while salinisation and waterlogging raises concerns of resource degradation. It is acknowledged that irrigated agriculture is one of the key options for attaining food security, even as competition for water between agriculture and urban use increases. The key issue in not whether irrigation is needed but whether it can be made more sustainable and water use in agriculture can justify its opportunity cost. The paper suggests that perhaps this is possible if what is defined as irrigation is expanded to include water harvesting- local collection concentration and conservation of rainfall runoff for agricultural production.

Grisley, W. and D. Mwesigwa (1994). Socio-Economic determinants of seasonal cropland fallowing decisions: smallholders in Southern-western Uganda. *Journal of Environmental Management* 42, 81-89.

The study is motivated by the observation that soil fertility management issues in economic context, with the exception of adoption of soil conservation practices, are lacking and some commonly held views such as land fallowing is incompatible with increasing population densities. The paper uses the Tobit regression model to study the determinants of cropland fallowing decisions of households in the densely populated, steeply sloped Kabale area of south-western Uganda during the second season of 1991. The 29 survey farmers were part of a larger group of farmers, participating in earlier on-farm research crop variety trial. These farms though not randomly selected were not unrepresentative of the households in the area. The endogenous variable was percent of household's cropland fallowed in current season. The factors hypothesized explain its variation were field size at homestead location, acres per household member, acres per

adult worker in household, percent of cultivated land intercropped, days per week wife works off-farm, percent of land on hillsides and homestead-field distance in kilometers.

Hatibu , N. E.A. Lazaro, H.F. Mahoo and F.B.R. Rwehumbiza (2004). Soil and water conservation in semi-arid Tanzania: Government Policy and farmers' practices. Soil-water Management Research group of Agriculture, Sokoine University of Agriculture, Morogoro Tanzania.

The objective of the paper is to assess national NRM policies with particular reference for soil and water management in relation to farmers' actual practices in semi-arid areas. The objective is achieved by reviewing policies on: land, agriculture, forestry and water in Tanzania, followed by a description of three case studies with a view to articulating the factors influencing adoption of rainwater harvesting technologies and highlighting the gap between government policy and farmers' practices and priorities.

Heisey, P. W. and Mwangi, W. (1996). ***Fertilisers use and maize production in sub-Saharan Africa.*** **CIMMYT Economics working paper 96-01. Mexico, D. F.: CIMMYT.**

The study is prompted by the observation that fertilizer use in the region to increase food productivity and low down the rate of environmental degradation has been slow. The situation of fertilizer use in maize is reviewed followed by factors influencing farmers' adoption and intensity of fertilizer use. Supply constraints to fertilizer use are linked to policy responses. Issues and options of fertilizer policy are give before the over all conclusions of the study.

ICRAF (1997). ICRAF Annual REPORT 1997

A summary of characteristics of high lands of eastern and Central Africa linking research themes and activities of AFRENA East Africa research programme to the constraints and opportunities in the region and giving research and farmer evaluated results of research work of three out of the four themes.

Jones, S. (2002). A framework for understanding on-farm environmental degradation and constraints to the adoption of soil conservation measures: Case studies from highland Tanzania and Thailand. ***World Development*** **30(9), 1607-1620**

The study is motivated by the observation that to date studies attempting to explain causes of land degradation only present partial picture or lack explanatory value because they fail to identify links and mechanisms between social variables and land degradation. Economic adoption models have shed much little light on adoption of soil conservation measures despite considerable effort. An alternative is suggested- a sociological framework applying structural theory and made operational in the actor-oriented approach is used to shed light on the interaction of people with technology and peoples interaction with factors which are potential caused of soil degradation. It focuses on how factors become causes of soil degradation based on four broad variables (perception, knowledge, incentive and capacity) that affect conservation decision-making. They can be used to identify the different circumstances in which certain factors or synergistic interactions of a few factors takes precedence over all other factors in determining detrimental action that results in degradation. The study data was collected from 60 farmers in Uluguru, Tanzania and 40 in Thailand using semi-structured questionnaire and participatory rural appraisal technique.

Kenya (2000) Interim poverty reduction paper 2000-2003. Government of Kenya

The paper outlines the strategies the Government intends to use as a national planning framework to guide detailed sectoral priorities, and budget allocations alongside policies, reforms, and programmes for the next three years to achieve the primary objective of development. This is stated as achieving a broad-based, sustainable improvement in the standards of welfare of all Kenyans.

Mureithi, J.G., C.K.K. Gachene, F. N. Muyeko, M. Onyango, L. Mose and O. Magenya. (eds) (2000). Participatory technology development for soil management by small holders in Kenya. Proceedings of the 2nd scientific conference of the soil management and legume research network Projects June 2000, Mombasa, Kenya.

The paper reports experiences on the how farmer participatory research was conducted in 1994-1996 and compares it to improvement made in the approach in 1997/98 with the basic recognition that farmers could be involved in other stage of research not just the diagnostic stage. This Soil Management Project initiative by KARI- Kitale, involved four communities in the first face, identified because they were experiencing soil fertility related problems. The initial participatory rural appraisal was carried out by multi-institutional and multi-research team. A fifth site was included in the second. The paper highlights the factors which affected farmer participatory research, lessons learnt and the challenges likely to face similar future initiatives

Karanja, D. D.; Thomas, S. J. and Straberg, P. (1998). Maize productivity and impact of market liberalisation in Kenya. Paper presented at the conference on "Strategies for raising smallholder agricultural productivity and welfare," Egerton University/Tegemeo Institute of agricultural policy and development, November 24, 1998, Nairobi, Kenya

The objective this empirical study was to explore the impact of recent market reform policies, specifically maize market liberalization on maize productivity. More specifically the study sought to determine factors influencing farm-level maize productivity, and to assess the impact of maize market reforms on productivity with special reference to the impact of maize price changes attributed to the reforms, on maize productivity. Data from 1540 households from 8 agro-ecological zones and 21 districts was used. Population-proportion sampling was done of farmers operating less than 50 acres. Smallholders produce the largest proportion of maize in Kenya. The probit model was used to determine factors influencing maize seed varietal choice. The Tobit model was used to delineate determinants of fertilizer used, allowing for zero fertilizer use. Two stage least squares was used to determine the factors influencing maize productivity. Parameters estimated from the econometric model were in turn used to show the impact of the change in maize levels on the use of hybrid seed and fertilizer using simulation. The impacts were traced to their effect on maize productivity (Kshs per acre) using data from Ministry of Agriculture Market Information Bureau.

Keeley, K. and I. Scoones (1999) Understanding Environmental Policy Processes: A Review. IDS Working Paper 89, Institute of Development Studies, University of Sussex. UK

The paper reviews the literature with a view to understand the policy process by focussing on the environmental policy in developing countries. The approach is prompted by the notion that if one understands the relationship between knowledge and the policy process, then the focus of research shifts from policy analysis to policy process analysis. Three models are used to illustrate what policy is thought to be. The linear model views policy as agenda setting, decision making followed by implementation. The second model views policy as courses of action or part of on-going process of negotiation and bargaining between multiple actors over time. The third model considers policy as operation of technologies entwined in relations of power between citizens, experts and political authority. The role of science in policy process is elaborated to show how science acts as a basis for policy issues, debates and popular concerns. In turn, that same policy influences the way scientists dealing with policy issues conduct their work and frame the problems for investigation. Three ways are given to explain how policy change occurs. Each is illustrated with a real life example.

Kherallah. M.; Delgado, C.; Gabre-Madhin, E.; Minot, N. and Johnson, M. (2000). The road half travelled: Agricultural market reform in sub-Saharan Africa. Food policy report, **IFPRI, Washington, D. C**.

Market reforms have led to a decline in the use of inputs and access to credit. The reforms have been huddled with problems such as partiality in implementation, policy reversals and weak government commitment. Future agenda must include full implementation of reforms, addressing the problem of vulnerable groups in remote areas and instituting credible, sustainable macro-economic policies among others.

Kimuyu, P. (1998). Conditionalities and market reforms: What Kenya's fertiliser market reveals. Occasional Paper No. OP/03/98. IPAR, Nairobi, Kenya.

The paper traces the reform process of the fertilizer market and the role played by the conditionalities set by various donors, and in particular USAID. It highlights the problem faced by recipient government in finding appropriate response when aid philosophies of donors translate into different conditionalities. Since the main fertilizer programmes covered about three years the government did not have adequate time to internalize the burdensome conditionalities set, some of which were too broad to be implemented and monitored- sometimes made cosmetic changes to appear compliant. In the process they sacrificed long term judicious decisions on fertilizer policy

Kinyanjui, H. C. K.; Obanyi, S. N.; Onduru, D. D.; Gachimbi, L. N. and Nandwa, S. M. (2000). Stakeholder perceptions of agricultural policies in Kenya. Managing Africa's soils No. 18, IIED and IDS, UK.

The paper emphasizes the need for a comprehensive land use and environmental policy to combat soil degradation in the place of much ad hoc legislation. The paper also emphasizes the need farmers' involvement in the formulation of soil and water conservation policies.

Kowero, G. (2003) The challenge to natural forest management in Sub-Saharan Africa rural development: Experiences from the miombo woodlands of Southern Africa. In Kowero, G., B. M. Campbell and U.R. Sumaila (2003) *Policies and governance structures in wood lands of Southern Africa* (eds). Center for International Forestry Research (CIFOR), Jakarta Indonesia.

This is the first chapter in this book. It gives a brief overview of natural forest estate and management in Sub-Saharan Africa in general, as a prelude to specific issues of the miombo woodlands of Southern Africa. It articulates the layout of the book which is based on research on the miombo woodlands of southern Africa that evaluated local community participation in natural forest management. It also includes how macroeconomic policies and sectoral government policies have shaped forestry. The potential for guiding forestry interventions in rural development is considered, to underline emerging lessons likely to have applications in managing other natural resources.

Kowero, S. G. (1995). Management of the Miombo woodlands of Africa: some critical issues. In: Bruns *et al.* (eds.) Dryland Forestry Research. IFS/IUFRO workshop proceedings, Hyytiala, Finland. Pp 31–46.

The paper outlines the uniqueness of the Miombo woodlands. It argues that there is little development in terms of scientific knowledge about the ecosystem in which they are found. The scientific basis on which many management decisions are made are weak. There is need to strengthen decision-making capacity of the people at the grassroots level.

Luoga, E. J. A. (1994). Indigenous knowledge and sustainable management of forest resources in Tanzania. Paper presented during the international conference on " Information acquisition for sustainable management of natural forest resources of east, central and southern Africa." Arusha, Tanzania, 31stOctober–4th November 1994.

This paper emphasizes the role of indigenous knowledge on research in sustainable management of forests. The technologies of industrial countries are not always suited for socio-economic and environmental conditions of developing countries. The paper envisages a conflict between the objectives of the local people and the national government in their conservation efforts. At the local level, people use forests to meet their basic needs while at the national level forests are an important source of foreign exchange, employment and government revenue.

Marquardt, A.M. (1994). Settlement and resettlement: Experience from Uganda's national parks and reserves. In: Cynthia, C. C. (ed.) *Involuntary resettlement in Africa: Selected papers from a conference on environment and settlement issues in Africa.* World Bank technical paper no. 227, World Bank, Washington, D. C. pp 147–159.

The paper assesses the increased incidence of encroachment of protected areas. The government has three policy options for settling of people i.e. resettlement, repatriation or

incorporation into the reserves. The viability of any of the options depends on the pull and push factors that led to settlement problem in the first place.

Mayers, J. (2003) National forest programmes and similar beasts: Current state of evolution, and future prospects of life (draft- prepared fro the Millennium Ecosystem Assessment). International Institute for Environment and Development (IIED)

The paper give a brief review of what is termed as "national forest programmes'' focusing on their origin, how many features constituting a good national forestry programme can actually be found on the ground including the way forward under the following subheadings: current trends, local pressure stimulating national forestry reform, international pressure stimulating national forestry reform, national forest programmes – emerge from the swamp and way forward. "National forest programme'' is understood to mean a wide range of approaches to the process of planning, programming and implementation of forest activities in a country to be applied at national and sub-nation levels, based on a common set of guiding principles.

Mowo, J.G., S.T. Mwihomeke, J. B. Mzoo and T. H. Msangi. (2002). Managing natural resources in the West Usambara Mountains: A glimmer of hope in the horizon. Paper presented at the Mountains High Summit Conference for Africa, May 2002, Nairobi, Kenya.

The paper outlines the major problems in natural resources management in the West Usambara Mountains, Tanzania, their evolution and impact. Four initiatives addressing the problem that is, soil Erosion Control and Agro-forestry project (SECAP), Traditional Irrigation and Environmental Development Project (TIPDO), Tanzania Forest Research Institute (TAFORI) and African Highlands Initiative (AHI) are examined, the impact of their activities evaluated and opportunities and goals to map the way forward are suggested.

Murithi, F. M. and Shiluli, M. C. (1993). Effects of the liberalisation of fertiliser markets on the distribution and use of fertiliser on food crop production: A study on

Embu and Meru districts of Kenya. In: ***Cereal grain policy analysis in the national agricultural research systems of Eastern and Southern Africa.*** **CIMMYT SADC/ICRISAT, Addis Ababa, Ethiopia. Pp 89–113.**

Fertilizer traders (23) in Embu and Meru districts and small-scale farmers (135) in Manyatta Division of Embu District were interviewed in September/October 1991. The study of the study was to assess the effects of liberalization on fertilizer trade, fertilizer use by small scale farmers on food crops and identify constraints emanating from policy.

Mwangi, J. G. (1999). Policy milestones in Kenya that have supported or constrained sustainable agriculture and poverty alleviation, Tegemeo Institute of Egerton University Draft Report March 1999.

The report is a review of past and current policies in Kenya, obtained by reviewing policy related documents and interviewing people knowledgeable in the subject matter. The people were selected from among involved in formulating, influencing or implementing policy in the past or were involved at the time of the study. The study was financed by DFID of United Kingdom with a view to elicit an understanding of policy success and failure in fostering sustainable agriculture and poverty alleviation as a potential input in subsequent policy formulation. The respondents were therefore selected from government ministries, parastatals, NGOs, private sector, research and marketing institutions and even religious organizations. A "cross-sectional survey" design was used to select the respondents. A structured questionnaire was used to interview them. The report covers the policy milestones starting with the colonial policy, among them the land tenure and consolidation policies, Swynnerton Plan, and natural resource management and conservation policy. Post-colonial (independence) policy milestones and policy elements of 1960-1980 include human settlement, agricultural research, rural financing and agricultural inputs policies. Finally, structural adjustments policy and elements of policy 1980-1990 are covered such as permanent presidential commission on soil conservation and afforestation, processing and marketing agricultural products policy, and post liberalization policies such as East African cooperation policy.

Mwangi, M.W. (1997). Low use of fertiliser and low productivity in sub-Saharan Africa. *Nutrient Cycling in Agroecosystems* 47: 135–147.

High rates of nutrient depletion as well as low levels of use of organic fertilizers are emphasized. Lack of producer incentive and stability is a major disincentive to fertilizer adoption in many SSA countries. Factors that hinder good performance of the private sector need to be investigated and addressed.

Nguyo, W., M.Bezuneh, B. Kaunga and D. Kariuki (2002). Alleviating poverty and food insecurity: The case of Mwea irrigation scheme in Kenya. Tegemeo Institute of Agriculturea Policy Analysis and Development, Egerton University and Clark Atlanta University, Atlanta USA

The main purpose of the study was to assess the impact of Mwea Irrigation Scheme on the welfare of the participant farmers, by comparing them with non participants (those who grew rice by diverting water secretly from the National Irrigation Board (NIB) canals for irrigation outside the scheme area). The results would inform policy on possible alternatives operated with the scheme and without the scheme and shed light on possible amicable solution to the conflicts that faced the scheme. The respondents were selected from 28 villages from three sub locations. Households were subsequently selected in proportion to the population of the village, resulting in 198 households within the scheme and 20 outside the scheme. Additional data was obtained from secondary sources including the NIB records and Mwea Multi-purpose co-operative society.

Nyang, F.O. (1999). Household energy demand and environmental management in Kenya. Ph.D thesis Universiteit van Amsterdam, Faculteit der Economische Wenschappen

One of the objectives of the thesis was to analyze the responsiveness of household energy demand to fuel prices and consumer incomes and how demographic and environmental factors influence these responses. It analyses the impacts of household environmental management practices on firewood consumption and supply and seeks among other questions answer the following questions among others: What is the impact of

environmental factors on household energy demand; What is the shadow price of collected firewood; What factors motivate the households choice fro fuels and what are their respective influences? What factors motivate households' choices in environmental management practices?

Nyangito, H. O. (1998). Agricultural policy in Kenya: Reforms, research gaps and options. IPAR Occasional Paper No. OP/02/98. IPAR, Nairobi, Kenya.

The paper very briefly reviews the agricultural policies implemented in Kenya since independence - before reforms and with reforms 1980 – 1995 with two objectives. First, to identify policy research gap and second to discuss policy weaknesses over the years in an attempt to propose policy alternatives which stakeholders can evaluate for improved agricultural growth.

Obwona, M., and D. Norman. (2001). Status of agricultural economics in selected countries in Eastern and Southern Africa. IFPRI 2020 Vision Net work for East Africa. Kampala, Uganda: IFPRI.

The ability of the universities in the region to produce sufficient numbers of well-trained agricultural economists to address adequately the need of the agricultural-based economies in the region is a question that has received increasing attention in the recent past. Those concerns result in this study. It was funded by Rockefeller Foundation and under taken by International Food Policy Research Institute (IFPRI) with collaboration from East and Central Africa Program for Agricultural Policy Analysis (ECAPAPA). The ultimate aim of the study was to suggest and evaluate possible ways to improve agricultural economics training capacity in the region. Other objectives were to; assess the current ability of academic institutions to produce well-trained M. Sc. And Ph. D. agricultural economists and to conduct research; review existing training programs for their suitability, strengths, and weaknesses, and indicate the areas needing attention; and to evaluate the market for agricultural economists, focusing especially on the supply gap, and provide some indicators on the demand for them. The necessary data and information was obtained by visiting 16 universities, eight research institutes, five national agricultural research

systems, four networks, 14 policy institutes and eight other agencies such as donor agencies and The World Bank, all located in nine countries in the region among them Kenya, Uganda and Tanzania. The authors, who are senior agricultural economists, were hired to undertake the study.

Omamo, S.W., D.W. Kilambya, and S. Nandwa (1999). ***Evaluating Research on Natural Resource Management: The Case of Soil Fertility Management in Kenya,*** **ISNAR Briefing Paper 41.**

The need to assess the potential economic impact of relatively new area of research- soil fertility replenishment- lend to collaborative effort between ISNAR and KARI's soil Fertility and Plant Nutrition Research Programme (SFPNRP) to develop a simplified ex-ante approach to evaluating research on natural resources. The potential returns to alternative themes and the likely distribution of any gains across the country were unknown; therefore bases for prioritizing research efforts and resources were lacking. The study divided the country into five research target zones using various types of information and identified four research themes: problem soil management, inorganic fertilizer management, soil organic matter management and technology transfer. For each zone, potential for technology generation and adoption, resulting farm-level yield gains under each theme were estimated and aggregated to show regional and national supply shifts for the affected commodities. The shifts were translated to reflect changes in economic surpluses or benefits.

Omamo, S.W. (2003). Policy Research on African Agriculture: Trends, Gaps, and Challenges ISNAR Research Report 21.

The report is based on a broad review of the literature argues that policy researcher and agricultural economists in particular have failed to address the real problems facing policy makers in Africa's agriculture because they have used research approaches which predominantly seek answers to "what and why " questions. The author strongly suggests that policy researchers should concentrate on research designs and methodologies which mainly give policy makers the answer to "how" question. To this end the suggestion is

made to case study institutional initiatives likely to yield policy-relevant results and the historical perspective within which they have evolved, employing multidisciplinary and network analysis concepts. The first-order focus should be implementation so that ex-post hazards are anticipated. In this process the policy analyst focuses on the real specific situation conditioned by history, political and power relations, distinguishes ideal but impossible out comes from possible but flawed ones. In this way, the policy analysts will have faced squarely the problems facing policy makers in African agriculture because they will have evaluated the operational feasibility of different policy options and will have promoted the feasibility of the most highly valued alternative.

Omiti, J. and M. Muma. (2000). Policy and Institutional strategies to commercialize the dairy sector in Kenya. IPAR Occassional Paper No. 006/2000.Nairobi, Kenya: IPAR

The paper review the literature on the development of the dairy sector in Kenya and note that although annual milk production exceeds the annual demand nationally, the dairy industry is experiences difficulties which deter it from achieving stable supply, increased income to farmers and protection of the consumers. The constraints persist even though the government introduced economic and institutional reforms to facilitate attainment of these goals. The reforms were meant to encourage private sector participation in providing breeding and veterinary services, farm inputs credit, marketing and processing leading to a sustainable dairy sector resulting from all stakeholders satisfaction. This has not happened. The paper therefore reviews policy option to harmonise the dairy sector under broad categories: producer incentives, institutional environment, pricing and marketing policies and investment environment with a view to generating debate to from the policy community

Pandey, K.D. and D. Wheeler (undated) Structural Adjustment and Forest Resources: The impact of World Bank Operations. Development Research Group World Bank.

In World Bank's view, structural adjustments loans (SAL) will enable developing countries to exploit the comparative advantage in labour-intensive activities and production that combine unskilled labour with land, minerals and forests as easily exploitable resources. In the process poverty will be reduced by expanding long-run employment and income opportunities for poor workers and farmers. But the environmentalists disagree pointing out the SAL undermines sustainability of resource use because they facilitate rapid resource depletion in economies that have little capacity to protect the commons because countries with comparative advantage in labour and natural resources intensive production are weak in regulating the use of the commons. In reply the bank suggests that implementing SAL removes distortions leading to increased efficiency hence reduced wastage in production sector compensating at least in part expansion in the sector. In addition SAL can create increased interest in environmental protection and increased prosperity to effect the protection. The study was prompted by the observation that since both views a plausible a priori, the effect of SAL on natural resource use and environmental protection is an empirical issue. Panel data of the period 1961 -1998 for 112 countries was used to estimate the impact of SAL on forest resources in developing countries using econometric for production, consumption, export and imports of wood products with special focus on round wood (partly fuel wood and charcoal) production because it provides the only direct measure of forest resource exploitation.

Pender, J.; Place, F. and Ehui, S. (1999). ***Strategies for Sustainable Agricultural Development in the East African Highlands*** **PTD Discussion paper No. 41, IFPRI, Washington, D. C., USA.**

The paper hinges on the fact that increasing poverty and degradation of natural resources in the Eastern Africa highlands basically seen to arise from an interaction of population pressure, declining agricultural productivity and unsustainable use of natural resources may have complex underlying causes which vary across the diverse local conditions found in the area. Therefore no one strategy of policy, institution or technology will fit all circumstances. The paper uses theoretical considerations and very limited empirical data of the different scenarios found in the highland of Ethiopia, Kenya and Uganda to suggest

seven or so potential pathways or strategies for sustainable development which can be chosen for different circumstances and points out the policies and institutional requirements needed for the strategy to be successful. The broad strategies are given as hypothesis rather than firm conclusions because detailed data for specific situation would be need to fine-tune them and evaluate costs, benefits and likelihood of success depending on the stakeholders.

Place, F., C. B. Barett, H. A. Freeman J. J. Ramisch and B.Vanluwe (2003). Prospects for integrating soil fertility management using organic and inorganic inputs: evidence from smallholder African agricultural systems. ***Food policy*** **28, 365-378**

The paper review the literature on past research focuses on examining the issues of complementarities of and synergies between organic and mineral nutrients inputs and the resulting potential for such complementarities to increase market activity and demand for purchased inputs. It points out that in general African soils suffer physical loss from erosion, nutrient deficiency, low organic matter, aluminum and iron toxicity, acidity, crusting and moisture stress. Land management practices are to blame for causing some of these problems and exasperating those that inherent in tropical soils. Integrated soil fertility management (ISFM) is described as expanding the choice available to farmers by increasing their awareness of the options and how they complement or substitute with one another. These relationships underscore that both organic and mineral inputs are needed and none of them can be entirely substituted by the other in sustainable crop production.

Place, F. (ed) (1995). Towards improved policy making for natural resources and ecosystem management in sub-Saharan. Results of a consultation meeting held at ICRAF, Nairobi, Kenya 2nd –6th October 1995.

This is a report of workshop sponsored by United Nations Environment Programme (UNEP) attended by 16 participants from ministries of agriculture, planning, lands, scientific research institutions, universities NGOs, farmer groups local government forestry department and national research organizations drawn from Kenya, Uganda, Malawi and Cameroon. The workshop intended “to improve the ability of governments to

develop policies and programmes for the sustainable use of natural resources as part of integrated ecosystem management, and to stimulate dialogue among the sectors to help bridge the gap and resolve conflicts. The workshop adopted participatory approach by starting with country-based working groups case studies to identify themes or key areas further consolidated in a plenary session as meriting detailed deliberations. These eventually were grouped into two broad categories that is rationalization of institutional structures and stakeholders participation Land management issues (mainly soil erosion, soil nutrient management, deforestation and fallow management) were the main focus but the discussion were not limited to them. The main output from the workshop was a list of the most significant obstacles in improving integration and harmonization to achieve sustainable ecosystem management and recommendations to overcome these constraints

Place, P., P. Hazell. (1993). Productivity effects of indigenous land tenure systems in Sub Saharan Africa. ***American Journal of Agricultural Economics*** **75:10-19**

The study was prompted by the debate on the effect of land tenure systems on land productivity. Survey data of 1987- 1988 of rainfed agriculture from Ghana, Rwanda and Kenya was used in formal econometrics modelling to test the following relationships: land rights and credit ; land right and land improvements; land rights and input use.

Place, F and K. Otsuka. (2000) Population pressure, land tenure and tree resource management in Uganda. The paper contributes towards understanding of the impact of tenure, population density, and other variables on tree resources, by assessing woody vegetation on the farm and off –farm and overlaying land use mappings with the boundaries of land tenure within parishes. A stratified sample was obtained from five parishes in Uganda, ensuring that enough *mailo* and public tenure cases were obtained and that recent aerial maps were available for the area. An econometric analysis was done.

Place, F. and **Migot-Adholla, S. E. (1998).** The economics of land registration on smallholder farms in Kenya: Evidence from Nyeri and Kakamega districts. *Land economics* 74: 360–373.

The paper advances that registration of titles is not perfectly correlated to level of tenure security perceived by farmers. Use of land titles as collateral for loans was limited. The titling programs should be demand driven. There is need to improve rural infrastructure, health and education and agricultural technology in order to improve welfare of rural people and to increase demand for land titles.

Raussen, T., G. Ebong, J. Musiime. (2001). More effective natural resources management through democratically elected, decentralised government structures in Uganda. *Development in Practice* 11(4): 460-470. The report describes a hands-on experience with community-led management of a watershed in two subcounties in Kabale District, south-western Uganda. It was estimated that more than 120,000 km of contour hedgerows requiring 3000 seedlings per kilometre would be needed.

Reardon, T.; Barrett, C.; Kelly, V. and Savadogo, K. (1999). Policy reforms and sustainable agricultural intensification in Africa. *Development Policy Review* Vol. 17: 375–395.

The paper advances the argument that appropriate technologies for sustainable agricultural intensification are available but crucial problems revolve around institutions, markets and policies that condition incentive offered to the farmers and their capacity to use those technologies. Inevitably the government must in the short to medium term play an active role especially on improving the private sector marketing infrastructure.

Shechambo, F. (1999). Macro-economic policy incentives and disincentives for biodiversity conservation: The case of structural adjustment and deforestation in Tanzania. In: *Economic incentives for biodiversity conservation in Eastern Africa.* Proceedings of a workshop held 11th–19th March 1999, IUCN, Nairobi, Kenya. Pp11–21.

The objective of the paper is contribution to clarifying the complex inter-relationship between macro-economic policies influence sectoral policies and activities such as agriculture and forestry through which people evolve livelihoods strategies which could

have negative and positive impacts on biodiversity conservation. The paper uses regressions to determine the impact of changes in fertilizer prices on quantities of fertilizers used, producer prices on areas of specific crops cultivated and the impact of changes in yield, cost of living and population on area cultivated. Macro level data is used to capture the changes induced by macro economic and sectoral policies in Tanzania (1978-1990) with special focus on effects of the structural adjustments.

Stahl, M. (2000). Land degradation in East Africa. In: Gichuki *et al.* (eds.) *Land and water management in Kenya: Towards sustainable land use*. Department of agricultural engineering, University of Nairobi, Kenya pp287–293.

The paper recognizes security of tenure as an important factor in the long-term land improvement. The paper advocates for a multi-disciplinary research to solve problems facing the farmers. There is also need to facilitate the extension workers to enhance adoption of soil conservation measures.

Strasberg, J. P., T. S. Jayne, T. Yamano,J. Nyoro, D. Naranja, and J. Strauss. (1999). Effects of Agricultural Commercialization on Food Crop Input use and Productivity in Kenya Proceedings of conference on Kenya Agricultural monitoring and policy analysis project, July 1999. Tegemeo Institue of Agricultural Policy and Development/Egerton University, Kenya Agricutural Research Institute and Michigan and Michigan State University.

The study uses descriptive analysis and two econometric models to determine the effects of commercialization at both the household and district level on food crop productivity and fertilizer use, using a national rural household survey done under the Kenya Agricultural Monitoring and Policy Analysis (KAMPAP) which is a joint venture of Tegemeo Institute of Agricultural Policy and Development/Egerton University, Kenya Agricultural Research Institute and Michigan and Michigan State University. The survey consisted of a single-visit to 1,540 households in April 1997 randomly selected to from rural areas in six provinces of Kenya, targeting smallholders who derive most of their income from rain-fed agriculture production. The sample was reduced to 1,465 households by excluded

households from arid areas of Turkana and Garissa Districts and any households farming land in excess of the 20 hectares (50.8 acres) holdings. Among the eight agro-regional zones covered three of them fall in the highlands- Western Highland (Kissi and Vihiga), Central Highlands (Muranga, Nyeri, Meru and Laikipia) and High Potential (Trans-Nzoia, Uasin-Gishu, Bomet and Nakuru). In this study household commercialization index was defined as [gross value of all crop sale in a stated year / by the gross value of all crop production in the same year] x 100.

Swallow, B. M.; Garrity, D. P. and Noordwijk, M. V. (2001). The effects of scales, flows and filters on property rights and collective action in watershed management. CAPRi Working Paper No. 16, IFPRI, Washington, D. C.

The paper argues that hierarchical scaling is important for understanding and addressing the problems of watershed management. But it is not possible to transpose principles developed at one level to higher or lower level. The paper emphasizes the importance of involving the local communities in order to ensure success of land and water management problems. The paper also underscores the importance of secure property rights in the conservation efforts.

Thompson, J .(1991). **Combining local knowledge and expert assistance in natural resource management: Small-scale irrigation in Kenya ed. The Center for International Development and Environment. Washington DC: World Resources Institute and Nairobi: Acts Press.**

This was a case study done in 1989 by Ministry of Environment and Natural Resources and Clark University US of the small-scale, gravity-fed, farmer managed irrigation system linking four communities in Nyeri District Central Kenya using Rapid Rural Appraisal. The report illustrates some critical resources and services that farmers require. The local and external components that influenced farmers' decisions and actions regarding the design, implementation, operation, and maintenance of the irrigation systems is the special focus of the report.

Tiffen , M., M. Mortimore and F. Gichuki. (1994). More people, less erosion : Environmental recovery in Kenya. Kenya edition African Centre for Technology Studies, Nairobi in association with Overseas Development Institute, London . Nairobi: ACTS Press

The book is based on the case study of Machokos District, in south-east Kenya, over the period of 1930-1990 by an interdisciplinary team mainly from the University of Nairobi with collaborators co-ordinated by Overseas Development Institute, London. It measured the changes that have taken place with a view to generating a theory of development from which policy lessons, likely to be applied elsewhere, could be generated. The major objective was to test the hypotheses on the relationship between population and growth and environmental conservation or degradation, using objective measurements of change over at least three long cycles of rainfall, estimated to be about 60 years. Implicitly the study sort evidence to support or to refute the commonly held assumptions for example, the relationship between commercial production and food production, population growth, number of trees and harm to the environment and the extent of increase in agricultural, productivity over the years.

UNEP (1995). Poverty and the environment :Reconciling short-term needs with long-term sustainability. Nairobi Kenya :United Nations environment Programme.

The report is abased on review of literature and attempts to link poverty and environmental degradation to the tendency of existing economic systems to externalize environmental and social costs of market transaction. It suggests an integrated approach to sustainable development which focuses on meeting the need of the most vulnerable in society.

USAID (2000). Nature, Wealth, and Power: Emerging best practice for revitalizing Africa. Washington DC: Environment & Natural Resources Team of USAD/AFR/SD.

This is a discussion paper under an on going program of compiling lessons learnt and information dissemination. It focuses on rural development in Africa and bases it arguments on lessons learnt over 20 years of natural resource based development in the

continent under the headings resources, economics and governance with example drawn from Namibia, Madagascar and Mali.

Townsend, F. R. (1999). ***Agricultural incentives in Sub-Saharan Africa: policy challenges*****. World Bank Technical paper no.444, The World bank, Washington, D. C. pp 93–116.**

Section 6 of the paper focuses on fertilizer policies, prices and markets. It outlines the fertilizer consumption trends and traces the evolution of fertilizer policies and markets. It gives a summary of the results of fertilizer adoption and use intensity studies in Africa and the evolution of fertilizer prices since 1980 and the factors driving. The 2KR Japanese Aid Program to Sub-Saharan Africa is used to demonstrate the likely adverse effects of fertilizer aid on the recipient country. The integral role played by policy reforms in Sub-Saharan Africa and the constraints faced are illustrated using case studies of Malawi, Zimbabwe, Ghana and Ethiopia them.

Rodgers, A. and Salehe, J. (1999). Woodland and tree resources on public land in Tanzania: National policies and sustainable use. In: Temu *et al.* (eds.) ***Off-forest tree resources of Africa.*** **Workshop proceedings held at Arusha, 12th–16th July 1999. AAS, Nairobi, Kenya, pp 313–335.**

Public land woodland and tree resources are lands that are nominally under village and district control. The paper shows that there is loss of tree resources from these lands at a high rate. However, the paper highlights the existing confusion about the actual figures on the amounts of deforestation or even the amount of forest land in Tanzania. The paper emphasizes the need more cross-sectional perspective in forest conservation efforts.

Wanzala, M. J. Owour, T.S. Jayne. A. Williams, J. Kirimi and J. Staatz. (2000). Reducing fertilizer marketing costs in Kenya: The way forward for the fertilizer sector. Tegemo Institute and Michigan State University collaborative research on the fertilizer industry in Kenya.

The objective of the paper was to report tentative findings of causes of high fertilizer marketing cost seeking comment from stakeholders as well as unravelling unanswered questions for further research with a view to coming up with ways of reducing costs. The study started in June 1999 using Tegemeo KAMPAP (then on going) and additional of data. The focus was DAP fertilizer because it formed 60% of fertilizer imports in Kenya in 1999. It is a grain a fertilizer with 35% of it used on maize. The average application is 35kg/acre while the recommended rate is 60kg/acre. Primary data was obtained from 612 household for 1996/7 and 1997/8 in 18 districts of Kenya. It also included 49 retailers and 12 wholesalers serving the long rains 1999 fertilizer application season, five importers, five transporters and two clearing agents.

Wickama, J.M. and J.G. Mowo (2001). Using local resources to improve soil fertility in Tanzania. Internationa Institute for Environment and Development (IIED) Managing Africa's Soils No. 21

The discussion papers in this series bring together several research programmes working on soil fertility in sub-Saharan Africa with activities focused on research on farmer management of soil fertility, and understanding the perceptions of the different stakeholders of how to improve soil management. The paper reports on a study of Kwalei Village in Tanzania, one of the Africa Highlands Initiative (AHI) promoted by the observation that farmers were aware that land productivity in their village was limited by soil fertility, fertilizers were available but unaffordable, the little amount used was lost through run-off on steep slopes, but only few farmers used leaves from locally available shrubs as green manure to improve soil fertility. The study tested the chemical composition, effect on soils and mineralization of plants identified by farmers in participatory research as effective sources of green manure. The research underscores the lack of information on indigenous shrubs used for green manure in other areas in the Highlands noting that an inventory needs to be made. It is also not clear how would the two shrubs found superior in this study would perform in other comparable areas. The study reports that a large number of farmers become interested in experimenting with

green manure, making compost and enriching it with rock phosphate because they were involve in the investigation right from start.

Wily, L. and O. Haule (1995). Good news from Tanzania village forest reserves in the making the story of Duru-Haitemba. Forests, trees and people Newsletter No. 29 November, 1995

This is a report of the events leading to the initiation of Duru-Haitemba Forest Village Reserve in Tanzania. It give details on how the local people came to lose their rights to forest resources to forest guards given the responsibility of guarding the forest reserve by the Government. In turn, the local people withdrew responsibility and the resource was exploited as open access leading to serious degradation from charcoal burning, clearing for farming, grazing, and pole cutting, authorized by the guards induced by illegal payments. The report documents how the local people reacted to save what they strongly viewed as their own resource through community based forest management and their performance up to 1995.

Young, M.D.B., J.W. Gowing, G.C.L Wyseure and N. Hatibu (2002) Parched-Thirst: development and validation of a process-based model of rain water harvesting. *Agricultural Water Management* 55, 121-140.

The paper focuses on rain water harvesting (RWH) describing it as all those varied techniques of collecting runoff for cultivation, by linking a runoff-producing area with a separate runoff-receiving area. Lack of technical knowledge is singled out as the main factor hampering RWH in Tanzania and liked to the following gaps in knowledge: (1) The ways farmers and extension workers can use to determine, among the available water harvesting technology (WHT), the one best suited to a specific field and the livelihood strategy of the farmer are not clear. The optimal configuration is not known (2) The methods of identifying additional areas which can benefit from a technique which has succeeded in one area have not been found. The study gives some empirical evidence of how the model termed as Parched-Thirst (predicting arable resource capture in hostile environments during the harvesting of incident rainfall in the semi arid tropics) is superior

among the competing approaches in understanding the interaction underpinning these questions. The interacting components arise from crop, soil, climate, topography and farmers management factors among others. The model can be used to simulate hydrology together with growth and yield of crops on any number of distinct or indistinct runoff-receiving areas and runoff- producing areas.

ANNEX 3

NRM POLICY RESEARCH INTERVIEWS

(These were done in Kenya and Uganda only[22])

Key people from institutions thought to have capacity for NRM policy research were interviewed to give their view on the main NRM issues focused by the review.

- key/major NRM policy problems
- key lessons from NRM policy research in the last decade
- way forward/ gaps in NRM policy research
- Capacity of institution to under take NRM policy research

UGANDA

The following people were interviewed in person the week of 14th- 19 July, 2003 using the subheadings in this report as open- ended questions and taking notes of their responses

G. Bahiigwa - Senior Research Fellow, Economic Policy Research Centre (EPRC)

M.Tenywa - Chair Department of Soil Science, Makerere University

D. Sseerunkuuma - Lecturer, Department of Agricultural Econmics and Agribusiness, Makerere University.

E. Nkonya - Research Fellow, Environment and Production Technology Division, IFPRI.

F. Bagooa - Natural Resource Management Specialist (Soils and Land Use), National Environmental Management Authority NEMA

I. Minde - Coordinator, ECAPAPA

A. Mugisha - Director, Uganda Wildlife Services (UWA)

(The interviewees for Centre for Basic Research, Kawanda Research Station and USAID were not available at the date and time confirmed earlier for the interview appointment**)**

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[22] **The support of all those who set aside time from their very busy schedules for the interviews is acknowledged with gratitude.**

Key/major NRM Policy Problems

Traditionally researchers start tackling the problem at the wrong level. The appropriate level is community level. This implies studying people and how they manage natural resources.

There is a tendency to perceive issues of NRM as an additional element in normal research activity. Much the same way gender issues in research were perceived some years ago. In their day to day activities, people interact with natural resources because those activities take place within the milieu of natural resources. Therefore, it is not possible to adequately study people and their activities such as farming, without taking in to account natural resources management component.

The challenge of NRM policy is to find ways and means of helping people to help themselves by investing in strengthening social capacity.

If the focus is natural resource management, it may not be farmers' priority. That farmers are not interested in resource management per se, possibly explains the failure or limited success of past initiatives. Therefore an approach that presents NRM issues in terms of livelihood objectives is likely to be more effective.

There is an interplay of lack of knowledge (ignorance), resource means and incentives in appropriate NRM. In the days gone by, farmers could meet their needs from farming and this was not paltry existence. Proper NRM must yield enough to meet livelihoods; if not they will not be adopted. Proper use of land should pay off the farmer to be of interest to the farmer.

There is lack of focus on the trade-off impacts of policy including compartmentalization of sections of government and the policies generated. For example, if markets are liberalized, what is likely to go wrong? Different outcome scenarios are not thought out and

anticipated. For example, liberalization may result in higher but uncertain prices. Price of inputs such as fertilizer can increase. At the same time, government may implement cost sharing policy, reducing public funding for education and health services. The little money that the farmer makes in these circumstances is unlikely to be spent on fertilizer or other NRM inputs because education and health take priority. The combined effect of policies and their interaction at ground level calls for rethinking.

Planned agriculture modernization (PAM) suggests that farmers can specialize in producing marketable commodities and use the income to buy what they do not grow. The implications of this scenario have not been adequately thought through.

By-laws of NRM from the colonial era exist but their enforcement and compliance are lacking.

It is clear that effective NRM is community based, even though certain elements of it that depend on individual farmers.

Colonial government was keen on soil conservation structures (SCS) even to the extent of using force to have them elected. Therefore people hated SCS and quickly abandoned them with attainment of political independence.

It appears that people do appreciate the value of SCS. Therefore, government has the duty to play an advisory and facilitating role. But the budget allocation to agriculture (about 1/5 of defence budget allocation) not only shows the low priority government attaches to agriculture but also explains lack of enforcement of by laws and failure of advisory and facilitating role in NRM.

Lack of a strategic plan addressing policy gaps is lacking to guide formulation of research agenda and hence the results obtained have immediate application.

The whole mechanism of dissemination of research results requires rethinking.

Land management policy does not exist. Wildlife gazetted areas have resulted in too little land relative to people's needs generating conflict in use. It appears there in need to provide land use and land suitability guidelines for use by people managing them or those giving advice to them.

The meaning and implication of decentralization and how to implement it is not clear and is still evolving. Possibly, the soil policy docket should have been retained the in the ministry of agriculture. It is currently under the mandate of NEMA who use consultant services.

Government's policies on research and extension for example change even before the stakeholders have had enough time to internalize them. Their role in providing guidelines is undermined.

Programs/projects/ initiatives are undermined by unscheduled reviews because they cause uncertainty among staff prompting to pause to make sure they have not lost their jobs.

Key lessons from nrm policy research in the last decade and way forward

Success can be achieved in educating people on NRM and people can learn not to hate SCS .For example in Lushoto SEKAP/GTD has been instrumental in tree planting and erecting SCS.

NGOs can help in implementing components of NRM at ground level.

Empirical evidence is available to show that in areas where NGOs have previously worked on agriculture and environment issues, there is significant reduction in soil erosion.

Notable features of NGOs operations which NRMPR can apply:

- They use local extension workers and facilitate them with equipment such as motor bikes and small day trip allowances.
- The staff are on the ground in far-off rural areas helping people implement what they preach, unlike government officials preaching NRM from air conditioned offices in the capital.
- The success at the ground level is attributed to the local staff and they are given recognition for the effort: morale is boosted.
- The approach works, yields results and does not cost billions in funds: there is need to try this approach in order to turn round NRM problems.

Empirical evidence shows that liberalization has resulted in low output prices and high input prices. Therefore fertilizers are only applied to soils of high potential because it does not pay to apply it to soil of low potential. Farmers continue to cultivate land until the soil is totally exhausted. Then they look for other survival alternatives: migrating to urban areas in search of jobs is one of them.

To adequately capture NRM issues and the wide variation of factors influencing them, there is value in focusing research analyses at the different levels in which decision are made such as, community level, household level and plot level. Empirical evidence from nutrient balance analysis shows that poor yielding plot receive no fertilizers.

Removal of trade tariffs is likely to improve the link between deficit and surplus areas in production of crops such as maize, encouraging exploitation of comparative advantage in region. The amazing effect of availability of markets on production is demonstrated by: current maize production in Uganda. Maize appears to out-compete coffee and banana production because World Food Program (WFP) buys it to feed refugees and displaced peoples generated by the surrounding unstable neighbouring countries.

If removal of internal tariffs is planned to be completed by 2008 so that the region becomes a customs union, then inputs such as harmonization of seed standards need to be put in place.

Decentralization has resulted in allocation of grants to local level needs unlike in previous years where grants were centrally allocated. The focus on local needs will facilitate monitoring the trends of important NRM variables such as fertilizer level application, yield level and ground water contamination.

Change in government has introduced and strengthened multi-sectoral thinking. PAM grant implementation demands multi-sectoral thinking. There is also evidence of and demand for empirical research based policy. The value of research input in policy formulation is increasingly being appreciated. The tendency appears to make mandatory research input in policy formulation.

Encourage those who are making progress such as I@mak.com which is an outreach of Makerere University that takes research results to farmers by recognizing them as partners in research. Providing the framework and policy for research is a significant component of the encouragement needed.

Issues of integration in NRM policy research - Integration was viewed as a very big challenge and others describe it as a big problem. Usually participants have different outlooks to the problem. These differences are heavily emphasized at the beginning of the interaction. But with time as dialogue progresses stark differences tend to tone down and often there is an emergence of some semblance of consensus.

Capacity of institutions to Carry Out Policy Research

There was evidence that people are groping with the concept and meaning of natural resource management research and in all cases fairly lengthy elaboration of the sort of issues at stake was required.

NRM is an illusive concept. Currently many of our researchers are unaware of it and they do not understand it. Therefore there is need to enable researchers to understand the nexus of NR and people by instructing them on appropriate methods and use of tools to understand the conflicts which arise as people use NR.

An initiative such as this interview on NRM concerns demonstrated that there is need to map out areas in the region where NRM research is concentrated and the reasons explaining it. This is a possible research topic.

NR concerns can be grouped under the following four headings: use, management, sharing (intergenerational component) and conservation. Use and management can be combined as utilization.

It was emphasized that in order to adequately response to the question of whether or not an institution has capacity for natural resource management policy research (NRMPR), one needs to answer the question "capacity to do what?" The answer makes possible listing what is needed in terms of people, skills and tools.

Since NRM is a cross cutting issue like gender and governance, defining what requires to be done is difficult and challenging. Even if NR are viewed in simple categories as land, water and forests, each category can be subdivided further even before the influences of factors such as trade and liberalization policies and political will compound the analysis.

Most respondents took "capacity" to mean people. Nearly all the respondents held the view that people to do research are available in research institutions such as the university (Makerere) and other NARO. Therefore relative to implementation component of NRMPR, capacity in terms of people is not a major constraint. It could be stated that up to 60% of the people needed are available. It is assumed that training for normal replacement and attrition is going on.

An alternative view (illustrating the wide variation perception of NRNPR) was that, if what needs to be done, that is, the task ahead in taken fully into consideration with all its implications, then capacity is limited; capacity not just in numbers of researchers in institutions but in other dimensions. In other words capacity is lacking or limited relative to the problem at hand.

In adequate capacity possibly explains inadequate existing policy. This is not surprising because, policy issues form a very minor component of teaching at the university. Moreover those imparted with the knowledge and skills at the university applicable to NRMPR end up in alternative employment.

The capacity for coherent NRMPR is even more lacking because the government has not put in place a framework within which research and policy fits.

At the University level there is plenty of theory and limited chance to test it and apply it.

International organizations such as IFPRI have capacity in terms of people for NRMPR. Indeed research to inform policy and policy process is their stated mandate. A project focusing on the highlands of Ethiopia and Uganda is in the analysis stage. However, local capacity for NRMPR assessed through non local organizations and projects which typically last 2 to 3 years raises concern in view of continuity and the long term nature of NRM issues. In deed to produce results at community level, NRMPR calls for a cycle consisting of policy data collection, analysis, policy dialogue and policy action.

At national level (Uganda) research capacity in terms of people exists. Equipment is lacking. However the remuneration to fully qualified professors/researchers at the university is unrealistically low and their plight is fully understood by those who worked in these institutions and have the opportunity to work for international research organizations

locally. Poor pay breeds a certain kind of behaviour in the researcher, hostile to policy research for NRM:

- They become consultants driven by incentive to make quick money.
- The ethical and moral standing of the researcher is compromised because conclusions and recommendations are made without appropriate rigorous and empirical testing to back them up.
- Is questionable if professors generating that type of work actually do teach appropriate methods and ethics of conducting research to students.
- The pity of it is that these professors hold superb qualification from world renowned universities.
- This type of consultancy is akin to salesmanship, aiming at producing an impressive looking report even though the conclusions and recommendations are essentially lacking in empirical backing.
- The time frame within which consultancy is required to produce the report is too short and hurried. It fails to meet the time frame and requirements of research to inform policy particularly on NRM issues as underscore by the policy cycle shown above
- Therefore local institutions staffed by this type of researcher have what can be termed as “white elephant capacity” for NRM policy research.
- Concerns of capacity also underscore the observation that governments in the region readily pay foreign researchers hefty salaries while they pay pittance to local researcher of equivalent qualification.
- It was pointed out that in Ethiopia professors are reasonably remunerated and they deliver research results.
- The possibility retaining professors to teach at the university while collaborating with international organization in research, who will pay a top-up salary as incentive is frustrated by the existing employment regulations. The dilemma often results in the university loosing the professor, reducing the capacity of the local institution to carry out research.

Researchers and policy makers some time assume “ago it alone” mind set looking down on the role and contribution from the other party. Policy implementers are on the ground and take the blame when research recommendations fail; at that point in time the researcher is long gone.

Keenness and commitment/dedication to carry out research is lacking.

Ability to communication research results is also lacking. One of the views expressed was that policy makers need not seek out researchers and their research results.

The effectiveness of researchers at the university is reduced because they are involved in too many short term projects simultaneously. These are least suited to NRM policy research, implementation in outreach and impact assessment.

KENYA

A.L. Alusa – Deputy Director, Regional Office for Africa

H. Nyangi'to – Research Fellow KIPPRA

G. Murila - Deputy Director KETRI

A. W. Karanja - Africultural Economist World Bank

R. Michieka - Director General, National Environment Management Authority

F. Murithi - Head, Socioeconomic Division, KARI

W.K.Yaban - Dean School of Environmental Studies, Moi University

- The introduction of structural adjustment started in the early 1980s. Yet it is only in the Sessional Paper 1 of 1986 that they are addressed at length. Government faced policy problem in the liberalization process particularly for maize as demonstrated by on and off liberalization of maize in particular since 1993.
- A major problem exists in the liberalized markets of commodities because the liberalization policy is not accompanied by the necessary changes in the legal frame work legal to facilitate their implementation.
- Policy utterances are in some cases made with the benefit of empirical findings included in the in-house policy briefs and cabinet briefs which are normally confidential material not accessible to the public. Inspection of sessional papers sometimes reveals the source of empirical findings influencing the statements.
- Capacity for applied research exists but applied research is not of it self policy research because the results are given in a manner that is not user friendly to the policy maker. Policy maker want recommendations that are actionable. For this reason researchers have to move their results an extra mile and come up with doable recommendations. But it must be fully acknowledge that policy statements if even those which have benefited from empirical findings have to take political implications into account.

To increase the input of empirical findings in policy

- policy maker as one of the consumers of the research findings, the researcher and the farmer need to be involved from the beginning of the research.

- Sometimes the government initiates the research as they have done in the past for tea and coffee, animal health and sugar.
- Government policy consists of declared intention of the government. For policy to have an impact on the ground, it has to be implemented. In tracing the impact of policy on the ground, one has to bear in mind that a correct policy could be wrongly implemented. Moreover one has to have solid evidence that the desirable change observed on the ground is due to the specific policy and not other factors.
- Policy research does not belong to any one institution. In the past it was wrongly believed that it belonged to government ministries alone.
- Integration in policy research with stakeholders is crucial. KIPPRA has found to it more effective to collaborate with government and subject specialist. If one of the collaborators is one of those who compose policy briefs to cabinet and ministers, then the chances of the research findings influencing policy are very high.
- Despite agriculture being recognized as the sector generating most job, livelihoods and supporting agro based industries which form a substantive part of the industrial sector, it is taken for granted as show by the reduced % of the total budget allocated to the sector.
- Way forward for policy research is to involve stakeholders as much as possible those who write policy papers and policy briefs because they should be the consumers of the research results in addition to the traditionally recognized stake holders such as farmers.

The capacity for institutions to under take policy research is under mined by the following factors:

- Multidisciplinary disciplinary team approach (veterinarian, economists, sociologists, and environmentalist) is needed and has shown superior results than single discipline approaches used in the past. But the common objective can be undermined by lack cohesiveness in the group.
- Funds from government for research have dwindled and forcing individual researchers to solicit for funds. The result is small segmented projects whose impacts are difficult to see.

- KETRI has now completed mapping of tse tse fly distribution in Kenya. This facilitates efforts to eradicate the fly systematically from a specific area. The areas targeted first are those which lies wholly within the boundaries of Kenya..
- For Stationary targets to be effective in killing tse tse flies the adjoining area has to be cleared regularly. This responsibility lies with Kenya Wildlife Service (KWS). Sometime the clearing is not done bemoaning shortage of funds.
- One the over riding concern of animal health is that farmers are not accessing the right drugs and the ones administered are not done so correctly. This suggests that even though there is liberalization of the animal health industry, the public sector has to control the quality of drugs and ensure that they are correctly administered.
- In the past when animal health services were adequately provided and controlled by the public sector, disease free zones could be established as a basis for meat exports. This is no longer the case.
- Success of an innovation such as tse tse fly control can have its own problems. For example, successful control of tse tse fly can allow number of animals to increase to a level likely to overwhelm the fragile ecology.
- Successful innovation can also increase the number of animals targeting meat markets. But if markets fail to expand or if they collapse altogether, anticipated funds are no longer available to make the innovation sustainable.
- Collaboration between institutions dealing with the same or related concerns can facilitate achievement of their stated objectives and increase overall efficiency of research resources. Collaboration of KETRI and ILRI would facilitate net working and lobbying on common policy issues. Another key collaborator is KWS as stated earlier. The Director of Veterinary Services who has the mandate for disease control and is therefore another main collaborator .

KARI

- Fertilizers obtained through coffee co-operative were used on coffee and food crops. Therefore collapse of the co-operative will have negative effects on production of food crops.
- Construction of terraces to control soil erosion has to take into account the opportunity cost of labour.
- It is doubtful if low input technology can be relied on to provide the large increases in agricultural production to keep pace with population increase.
- The ARF is a competitive research fund under KARI available for competitive biding for KARI and non- KARI staff.
- In general the amount of research funds attracted by individual researchers depends on how aggressive they are in soliciting for funds.
- KARI involves farmers as stakeholders to identify the problem in KARI mandate areas. Diagnostic surveys and farming system approach is used. For example, if a storage problem, start-up capital is provided and appropriate training given.
- Farming system approach in research requires multidisciplinary approach. If the farm is considered an entity, then the impacts of interventions are more likely to be seen.
- The approach of addressing the problems faced by farmers face in a continuum (from production right through to marketing) is more realistic.
- KARI encourages policy advocacy for example by inviting the parliamentary committee for agriculture to visit KARI to appreciate first hand the past and on going research work.
- Way forward – it appears that complete removal of support to farmers by public sector need to be replaced with well thought out selective support. Innovation for adoption is not lacking. What appears to be lacking are the means and the incentives for the farmer to adopt them.

- Collaborative efforts exist between KARI and ILRI, ICRAF and CIMMYT. However it appears that researchers should aim at giving the policy maker one message without contradiction .The message is more likely to find its way into policy.
- It is not clear how policy is defined. KARI has capacity for NRM policy research but probably at a different level from that done by KIPPRA or IPAR.
- There is high turnover of staff because KARI salaries are not adequate incentive to retain high caliber researchers.
- Some of the reforms have not been accompanied by sufficient legal framework, for example, the co-operatives
- The budget allocated to agriculture and to research is too little compared to the contribution of agriculture to GDP.

World Bank

- There at least five ministries that control rural space- agriculture, livestock, environment, water housing and public works. The problem is that their efforts are not coordinated although their expressed interest is the welfare of rural people.
- The agricultural productivity started falling in the 1980s and has continued to the 1990s.
- There is no clear cut policy on land use. For example the issue of land subdivision raises concerns which have not been addressed.
- Policy utterances are made to play to the gallery because they are not followed thorough with a budget for implementation.
- There is evidence that credit by government for agriculture does not serve the purpose for which it was intended and is not repaid. Yet the government is still lending to farmers and forgiving them for defaulting on payment.
- Considering regional trading blocks like COMESA, it is not clear what commodities give the country an advantage? For example is Kenya competitive in sugar production?

- Lack of vision appears to be one of the major reasons for lack of tangible progress in agricultural production. For example, government saw the structural adjustments as an imposition rather than an opportunity to adjust the regulatory mechanism.
- Usually policies guiding input and output agriculture markets are vague.
- There is need to give farmers space to have a say in the management of entities which conduct business on their behalf.
- It appears that policy research done locally is not influenced by global or even regional trends. For example, it does not take into account potential likely to come from COMESA. Globally, vertical integration link up farmers to sale outlets such as super markets. It is not clear what lessons emerge from this trend for Kenya.
- What efforts are in place to make sure that Kenya meets the phyto-sanitary requirement of the export market it is targeting such as the EEU.
- Local researchers and public sector policy analysts lack incentive because of poor remuneration and lack of even basic facilitation at their place of work.
- Way forward is to consult stakeholders such as farmers in determining research priorities.
- Land use policy is needed to guide issues such as subdivision which have important impacts on NRM.

UNEP

- In Kenya agricultural production is declining because farmers can no longer make money. The inputs are too expensive. How can the government protect the farmer? There used to be subsidies such as GMR. In addition, Kenyan farmers must compete in their own markets with heavily subsidized commodities like maize from US.
- Poor distribution of maize to deficit areas produces artificial shortages.
- Some agreements like COMESA need to be revisited? How will it affect the local producers? For example, cheaper maize is invading markets from Uganda.

- Low production means that even the wage that can be paid to labour is low, entrenching poverty and food insecurity.
- Corruption increases the cost of production and is a chief suspect in the price of local sugar. Similarly sugar imports are cheaper because they do not pay duty.
- Since government is no longer buying maize, the few buyers dictate the price.
- Lack of responsible leadership and lack of commitment to sustainable use of environmental resources enables to corruptors, polluters and degraders of the environment to get away with impunity such damping raw sewerage in to Lake Victoria. The result is less fish, less means of livelihood translating to more poverty and food insecurity.
- Kenya is not aggressive enough in pursuit for industrialization. Opportunities for making fertilizer and animal feeds exist because raw materials are available. Similarly titanium mining at Shimba Hills should locally processed, at least partly to create jobs. No country in the world seems to have broken out of the vicious cycle of poverty by remaining basically agricultural.
- The role of UNEP is to raise awareness at household level. It does so by holding the World environmental day in June and September.
- It also facilitates partnerships between the private sector, government and civil societies. There is renewed concern that the private sector has to shoulder it social responsibility.

Moi University

- It appears that although the objective of liberalization was to remove public sector interference from agricultural production, it has not resulted in increased agricultural productivity or income from the smallholder. In fact government failure has been replaced by an equally disabling market failure.
- Wholesale liberalization and privatization is not the answer to sustained increased productivity of the smallholder. It is also not a case of “all size fits all”.
- The process should be selective and cautious. For example, fragmentation of cooperative into small units resulted in loss of; economies of scale in processing,

basis for qualifying for loans from the cooperative bank, ability for bulk importation of fertilizers and credibility to do business because the business community does not want to deal with many scattered small units. In sum the transaction costs are too high.

- A mix of market and public sector involvement is needed, varying possibly with sector or commodity. The appropriate mix needs to be determined.
- A key component in the liberalization the feed industry is the quality of feed. Cattle dips have collapsed with public sector withdrawal.
- If is not clear if NRM policy exist and if it does it is not clear if it is understood. A framework is needed to guide policy. Framework consists of awareness, planning implementation, enforcement and evaluation.
- Conservation say of forest means wise use of forests.
- If the policy is "to achieve food security" the next concern is how to go about it. If it is through intensification of production by using fertilizers, pesticides and herbicides, then the possible negative effects have to addressed. For example, River Nyando is regard as one of the main contributors to the hyacinth problem in Lake Victoria- it carries all the residues of chemical inputs washed away from its large catchment area to the lake. In this case, the policy of food security conflicts with the policy of sustainable use of the environment.
- There are no guidelines on use of pesticides and herbicides to mitigate negative use.
- There is no evidence that agricultural policies are evaluated for impact.
- Way forward -It appears that time has come for professionals concerned with issues of environment to come together and form a lobby group for environment issues and gain cohesion for making significant input in topical issues such as formulation of the Environmental Act.
- Land policy that allows privately owned land to remain idle for years in the high potential areas is counter food security and poverty reduction policies.
- In the university, teaching and supervision leaves very limited time for research as would be needed for NRM concerns.

NEMA

- Policies are made without any reference to research input. All the research reports written do not influence policy pronouncements.
- Institutions in the country have capacity to undertake research but their performance is hindered by lack of finance for facilitation. For example issues of the Yala Swamp and titanium mining at the coast can be researched by our own people.
- Research funded from local sources has reduced tremendously.
- Lack of integration in research is caused by fragmentation of funding.
- The revival of the East African Community is a move in the right direction for the country and for the region.
- Mandate to undertake policy research is not exclusive to any institution.

ANNEX 4

Terms of Reference for the Project

"Review of NRM Policy Studies in the East African Highlands

(NRM Policy Research Review)

The overall purpose of this agreement is to facilitate the implementation of NRM Policy Research Review.

In order to focus the study, it is necessary to define "relevance" of existing studies in terms of a link to natural resource management. Policy research may be defined as relevant if it has an explicit reference to one of two areas:

- Inputs into, management of, and outputs from farming systems in the highlands. This would include policy studies related to seed and fertilizer input systems, on husbandry practices and cropping patterns, and on marketing of, and storage of outputs relevant to the highlands farming systems.
- Management of off-farm rural natural resources in the highlands. This would include management of forests, woodlands, wetlands, grasslands and pastures, and water resources.

Of priority for highlands agriculture will be NRM issues such as soil fertility depletion, soil erosion, loss of biodiversity, and deforestation. Policy research that is aimed at more targeted NRM policy, rather than broad macro-policy, should be given priority. Other policy research is of less priority.

Expected outputs

For geographical focus, the report will be limited to studies that have taken place in Kenya, Uganda, and Tanzania. University of Nairobi, Department of Agricultural Economics will submit to ICRAF a report that contains the following items:

1. A list of key NRM problems or policy problems related to NRM in the Highlands of Kenya, Uganda, and Tanzania.
2. An annotated bibliography of policy research studies relevant to each of the issues in (1).
3. A synthesis of key lessons from the studies included in (2).
4. A prioritization of key gaps for further policy research.
5. A list of the major research institutions in the region with capacity in NRM policy research.

Provisional outline of outputs

Executive summary

Tables of contents

I. NRM issues
   - A Issues in the macro context (regional and international)
   - C Issues in the micro context (national)
   - C Issues in the micro context (local)

II. Key lessons drawn from policy research studies

III. Important research gaps and second generation research questions

Annex 1. Annotate bibliography

Annex 2 Important research institutions in the region with capacity in NRM policy research

Activities

- The following activities are expected to take place in order to meet the expected outputs:
- Literature search using accessible computerized databases for relevant subject areas and countries.
- Visit to relevant government ministries, to research institutions, to private institutions, to universities and to donor agencies, including possible travel outside Kenya (see appendix 1).
- Compilation of relevant research analysis of relevant research.
- Analysis of relevant research
- Writing of Report

Appendix 1

Kenya

Ministry of Agriculture and Rural Development
ICRAF/ILRI/RELMA
KARI/KETRI
NES
UNEP
USAID/DFID/IDRC
WB
Kenyatta, Nairobi and Moi Universities

Tanzania
NEC
Ministry of Agriculture
Environment Department (in office of VP)
GEF-Arusha
Institute of Resource Assessment (Dar)
AWF-Arusha
USAID/DFID/EU

Uganda
NEMA
UWA
AHI-Kawanda Research Station

FRI
MAAIF
Facultu of
Forestry and Conservation (Makerere)

MIENR
MISR
USAID/EU/DFID
Centre for Basic Research